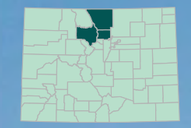
Northern Colorado Post-Fire Reforestation Strategy



Northern Colorado

Post-Fire Reforestation Strategy

American Forests™

Contents

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Executive summary

Since the early 2000s, Northern Colorado has experienced increasingly severe wildfires, leading to widespread forest loss and ecological damage. The Northern Colorado Post-Fire Reforestation Strategy provides a comprehensive, cross-jurisdictional framework for restoring these landscapes. Recognizing that both public and private lands require coordinated efforts, this strategy outlines a collaborative, science-driven approach to ensure forest regeneration and resilience.

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Key challenges

Increased fire severity: Increasing aridity and past fire suppression efforts have intensified wildfires, reducing natural regeneration potential.

Forest recovery barriers: Limited seed dispersal, high post-fire mortality and changing conditions have hindered reforestation.

Ecological and societal impacts: Wildfires have led to significant infrastructure damage, water supply challenges and biodiversity loss.

Reforestation assessment

To identify areas at risk of regeneration failure, the strategy utilized geospatial analyses and scientific modeling. The assessment identified 190,876 acres at risk of delayed regeneration or permanent forest loss, with approximately 72.7% on Arapaho and Roosevelt National Forests lands, 9.3% on Medicine Bow-Routt National Forest lands, and 7.0% on private lands.

Assessment methodology

Three approaches were used to determine areas requiring intervention:

1. **Modified RegenMapper approach:** Used high-severity burn areas and canopy-height data to identify regions with insufficient natural seed sources.
2. **American Forests' post-fire model:** Focused on basal area loss and proximity to viable seed sources.
3. **Rodman et al. (2022) approach:** Combined remote sensing and GIS modeling to assess regeneration probability.

All three approaches attempt to identify areas impacted by stand-replacing wildfire that are beyond common natural seed dispersal distances, as these areas are likely to experience delayed regeneration or regeneration failure. The Rodman approach yielded the most accurate results according to limited validation.

Additionally, the strategy prioritizes reforestation efforts based on:

- **Climatic moisture deficit** (identifying future drought resilience)
- **Distance to seed sources** (greater distances indicating higher intervention needs)
- **Topographic wetness index** (identifying moisture-rich sites for seedling survival)
- **Heat load index** (evaluating solar radiation effects on survival rates)
- **Proximity to water storage and watershed infrastructure** (protecting critical water resources)

Strategic goals

Resilient forest recovery: Promote resilient reforestation to restore forest cover, biodiversity and ecosystem services.

Sustainable reforestation pipeline: Strengthen seed collection, workforce capacity and nursery infrastructure to support large-scale restoration.

Partnership and collaboration: Engage landowners, government agencies and community organizations in joint reforestation efforts.

Adaptive management and monitoring: Use data-driven strategies to refine reforestation techniques and assess forest recovery.

Integration with existing plans: Align reforestation activities with federal, state and local land management policies.

Community engagement: Foster public support and participation in reforestation initiatives.

Forging an actionable path to a forested future

The strategy identifies 190,876 acres at risk of delayed regeneration or failure, prioritizing areas based on ecological, hydrological and other resilience factors. It recommends targeted interventions, including seed collection expansion and the establishment of a collaborative, to accelerate recovery. By leveraging scientific assessments and regional collaboration, this strategy aims to create resilient forests that support ecosystem health, water resources and community well-being.

Five overarching goals are outlined to increase the pace and scale of implementation across Northern Colorado to support the recovery of resilient forests:

1. **Increase the pace and scale of reforestation by addressing reforestation pipeline constraints**
2. **Support forest resilience**
3. **Identify and develop innovative funding solutions to support reforestation on public and private lands**
4. **Support monitoring and research across Northern Colorado**
5. **Increase reforestation on private lands**

This strategy, which is intended to be a living document, serves as a dynamic, evolving plan to guide Northern Colorado's long-term reforestation efforts, ensuring a sustainable, forested future in the face of ongoing challenges.

I

Background and need

In recent decades, wildfires across the United States have become larger and more severe, effects that are compounded by extended wildfire seasons (Westerling 2006, Cattau et al. 2020, Chandler et al. 2024). Colorado's forests evolved with wildfire, with each distinct forest type experiencing its own unique fire regime and co-evolutionary process.

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Regardless of the forest type, wildfire promoted a heterogeneous landscape, albeit at different scales and with different outcomes for each forest type (e.g., Addington et al. 2018). This heterogeneous terrain began to disappear with the loss of cultural burning and more than a century of fire suppression. With more homogenous tree cover across the landscape, forests began to dry out as a result of increasing temperatures and altered precipitation patterns. Weakened by these factors, Colorado's forests became more susceptible to disease and insect infestation, and as tree mortality peaked so too did dry, dead tinder. This is a common story across western North America, where many forests are said to be "fire-adapted," meaning their ecosystems evolved with fire and rely on it to thrive. Unfortunately, the weak forests now burn hotter, longer and further as homogeneity prevents natural fire breaks. Instead of fire scars of a few hundred or even a few thousand acres with varied impacts to soil burn severity and thus recovery, wildfires now burn hotter over tens to hundreds of thousands of acres with minimal chance of natural forest and ecosystem recovery.

Without efforts to holistically restore the landscapes impacted by these massive wildfires, we risk losing forested landscapes (Coop et al. 2020). As wildfire severity increases (Cattau et al. 2020, Chandler et al. 2024), seeds are unlikely to disperse into the core of large, high-severity burn patches. Even where seeds do arrive, the loss of climatic buffers and increasingly extreme conditions reduce the probability of tree establishment (Coop et al. 2020, Davis et al. 2023). These impacts are most profoundly felt in low-elevation, transitional forests (Davis et al. 2019, Parks et al. 2019), although declines in forest resiliency are expected across western forests (Davis et al. 2023).

In areas with declining resiliency, there is a risk of wildfire-driven forest conversion — a transition from one forest type to another, or from forest to non-forest vegetation (Stevens-Rumann and Morgan 2019, Coop et al. 2020). These transitions are driven by loss of seed-bearing individuals and the seed necessary to begin recovery. Areas with high pre-fire mortality caused by pest and/or pathogen outbreaks — like the recent mountain pine beetle outbreaks across the 2020 East Troublesome Fire footprint — can further hinder post-fire recovery because of additional loss of seed sources. Furthermore, unsuitable conditions for seed germination and seedling survival, driven by drought and increasing temperatures, reduce the probability of regeneration (Stevens-Rumann

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Without efforts to holistically restore the landscapes impacted by these massive wildfires, we risk losing forested landscapes.

et al. 2018, Stevens-Rumann and Morgan 2019). Non-forest states may be reinforced by competition from surrounding vegetation (e.g., shrubs delay tree growth) and reburns that kill regenerating trees (Coop et al. 2020). Given this suite of challenges, a large portion of the area that burned at high severity may be at risk of delayed forest regeneration or regeneration failure. Although this is especially true in lower elevation forest types, montane-grassland ecotone and dry mixed-conifer forests in particular, less is known about how these changes will impact post-fire recovery within higher elevation forest types — the water towers where many of our watersheds begin. Mismatches between current and future suitability for tree regeneration are expected, given observed increases in rates of burning and fire rotation periods driven by extreme events (Higuera et al. 2020, Chandler et al. 2024). Widespread restoration activities in post-fire areas are necessary to prevent forest loss and ensure that forest structure and composition are well-suited to future conditions and disturbance regimes (Lynch et al. 2021).

Colorado's forests are no exception to the needs of active restoration, having experienced the 20 largest wildfires in recorded state history since 2001, many burning with unprecedented intensity and speed. Northern Colorado has seen some of the most severe impacts from these large wildfires. Fifteen wildfires since 2000 have burned more than 540,000 acres across Northern Colorado — 5.5 times the size of Denver. Three of those fires hold the distinction of being in the top 10 largest fires occurring during recorded state history — the 2020 Cameron Peak (1st), 2020 East Troublesome (2nd) and 2012 High

15 wildfires since 2000 have burned more than 540,000 acres across Northern Colorado, an area

5.5x

the size of **Denver.**

Park Fires (6th) — that together burned more than 490,000 acres. Nearly 271,000 of those acres burned at low or moderate severity, with some of those areas undoubtedly experiencing positive ecological outcomes. However, the continuity and size of areas that burned at high severity, approximately 284,000 acres, challenge forest resilience mechanisms (Coop et al. 2020, Davis et al. 2023) and leave behind a mosaic of acute restoration needs.

Successful restoration of these forested landscapes and the ecosystem services they provide will require coordinated efforts across a diverse group of land managers, including the USDA Forest Service, private, state, county and municipal lands. To facilitate that coordinated effort, federal and state agencies, researchers, and community-connected partners have come together to develop a collaborative, all-lands approach to reforestation across the region's wildfire footprints, focusing on a partnership-centric approach to reforestation that supports ecosystem recovery and the suite of ecosystem services provided by our forested systems. Through cooperation among stakeholders, Northern Colorado can pave the way forward, reforesting the landscape in a manner that promotes ecosystem health and resilience to future wildfire and other disturbances.

A call to action

The forested landscapes of Northern Colorado have long been shaped by wildfire — both natural and cultural. Although historical fire regimes varied by forest type, wildfires sustained forest structures that were resilient to future wildfires and promoted biodiversity and landscape heterogeneity. These fire-driven processes were essential for maintaining key ecosystem services, including water provisioning and cultural values (e.g. Veblen et al. 2000, Schoennagel et al. 2011, Sibold et al. 2006).

However, modern fire regimes have shifted dramatically. Due to decades of fire exclusion policies, the decline of cultural burning and warmer, drier conditions have led to increased wildfire severity and frequency as well as longer wildfire season length (Westerling 2016, Stevens et al. 2017, Hessburg et al. 2021). Northern Colorado's 2020 wildfires alone accounted for more than 75% of the acres burned in the region since 2000, leaving immediate and devastating impacts. The East Troublesome Fire took two lives and destroyed hundreds of structures, while suppression costs for the Cameron Peak and East Troublesome Fires alone totaled nearly $150 million (NICC 2022). Across all forest types and elevation bands, countless trees were lost.

Beyond direct destruction, the aftermath of these fires continues to negatively impact the region. Damage extends well beyond burned forests, impacting critical infrastructure, water availability and long-term ecosystem health. The magnitude of peak snow-water equivalent has diminished, peak runoff now occurs earlier, and snow-free dates have advanced by approximately three weeks (Kampf et al. 2022).

Northern Colorado's 2020 wildfires alone accounted for more than 75% of the acres burned in the region since 2000.

In 2021, the Black Hollow Flood, originating in the Cameron Peak Fire burn scar, triggered massive flooding and debris flows across multiple watersheds feeding into the Poudre Canyon. This disaster resulted in four lives lost, six homes destroyed and nearly $1.7 million in damage to public infrastructure (de Leon 2021). Water providers were forced to cut off intakes and rely on secondary water supplies due to heavy sedimentation and ash contamination. These impacts have not subsided over time — continued sedimentation, road closures from mudslides and infrastructure damage further emphasize the urgency of restoring these severely burned landscapes.

While recent fires have had some ecological benefits in parts of the landscape, the widespread high-severity burns are disrupting natural recovery mechanisms (Coop et al. 2020, Hessburg et al. 2021, Davis et al. 2023). Without a comprehensive effort to restore these landscapes, we risk losing not only forests themselves (Coop et al. 2020), but also critical resources such as water supplies, carbon storage capacity and the potential for natural climate solutions. Additionally, habitat for endangered and culturally significant species could be compromised. Integrated, landscape-scale restoration presents a vital opportunity to prepare forests for future conditions and enhance resilience against future wildfires.

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Across the western U.S., wildfires are accelerating forest conversion — transforming forests into different vegetation types or even non-forest landscapes altogether (Stevens-Rumann and Morgan 2019, Coop et al. 2020). These shifts are driven by the loss of mature and old-growth forests, changes in species composition and fuel accumulation. The loss of seed-bearing trees, coupled with harsh conditions for seed germination and seedling survival — exacerbated by rising temperatures and drought — further hinders forest recovery (Stevens-Rumann et al. 2018, Stevens-Rumann and Morgan 2019). Once forests transition to non-forest states, feedback loops from surrounding vegetation — such as shrub encroachment that inhibits tree growth — and recurring fires that kill regenerating trees can reinforce these changes (Coop et al. 2020).

A substantial portion of the burned areas now face delayed or even halted forest recovery, particularly in transitional forests at lower elevations. These ecosystems are among the most vulnerable to the negative effects of high-severity wildfire in an increasingly warm and dry landscape (Stevens-Rumann and Morgan 2019, Wolf et al. 2021). That said, not all wildfire impacts have been detrimental. In areas where fires burned at low or moderate severity, forest conditions may have improved — reducing tree density and removing less fire-tolerant species that had encroached in the absence of fire.

A substantial portion of the burned areas now face delayed or even halted forest recovery.

Restoring these fire-impacted forests is not just about rebuilding tree cover — it is essential for maintaining biodiversity, wildlife habitat and vital ecosystem services, such as carbon sequestration, water filtration and future resilience. While natural forest regeneration may occur in some areas, increasing fire severity and more frequent droughts driven by a changing environment are severely limiting the capacity for post-fire recovery across the western U.S. Without strategic intervention, many of these forests may never return.

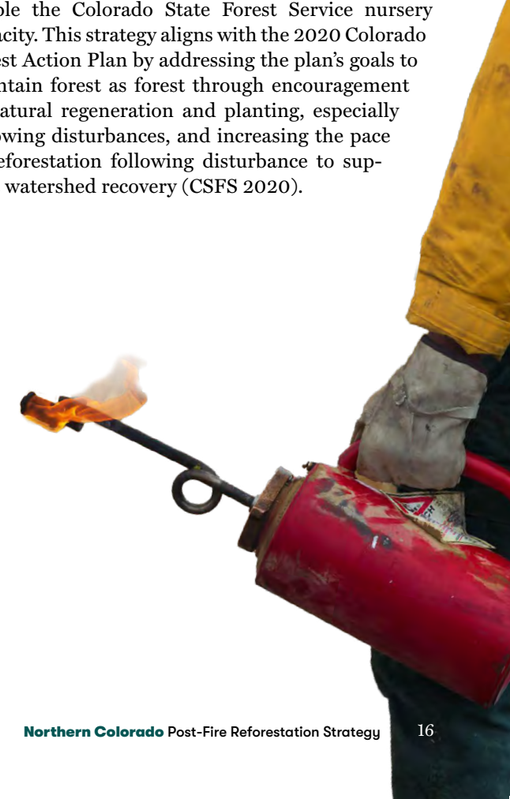
The funding and policy landscape

Successful reforestation efforts require sufficient funding and policies to support and prioritize reforestation activities. In the past few years, we have seen a flurry of investments into reforestation as a renewed priority. In November 2021, Congress passed the Infrastructure Investment and Jobs Act (Pub.L. 117–58), which included the Repairing Existing Public Land by Adding Necessary Trees (REPLANT) Act (sections 70301–70303). The REPLANT Act mandates that the USDA Forest Service address its reforestation backlog within 10 years. That backlog is currently estimated at approximately 3.5 million acres nationwide. In Northern Colorado, the reforestation backlog on National Forest System (NFS) lands includes the wildfires covered in this strategy; additionally, areas burned prior to 2000 contribute to the backlog and will require additional consideration but fall outside of the scope of this strategy.

Importantly, the REPLANT Act increased funding for reforestation by removing the $30 million cap on the Reforestation Trust Fund (RTRT) by amending Section 303 of Public Law 96-451 at U.S.C. 1606a, allowing the fund to receive additional revenue from tariffs on imported lumber. This change has raised available reforestation funds to over $200 million annually for the foreseeable future, though the amount may vary each year. Importantly, the changes to the RTRT are permanent, ensuring a sustainable funding source for reforestation in perpetuity. In the year following passage of the REPLANT Act, the number of acres reforested across the country increased to nearly 10% higher than the previous 10-year average (Pike et al. 2023).

A flurry of additional federal policies released in 2022 align with the goals of this strategy. Executive Order 14072, issued on April 22, 2022, emphasized the importance of reforestation on public lands in response to disturbances like those in Northern Colorado. Subsequently, the USDA Forest Service adopted novel policies and incentives to enhance resilient reforestation and forest management, with a focus on forest resilience. This directive includes a push for resilient reforestation within wildfire footprints and calls to expand cone collection and nursery capacity through collaborative, cross-jurisdictional approaches. Further, the actions detailed in this strategy align with the USDA Forest Service's Climate Adaptation Plan, released in July 2022, which highlights increased wildfire activity and extreme events like droughts as primary challenges affecting the USDA Forest Service's mission and reforestation demands. The Climate Adaptation Plan states that resilient reforestation and controlled burns are vital to managing ecosystems for sustainable change. Lastly, the USDA Forest Service introduced its Reforestation Strategy, also released in July 2022, which emphasized the urgent need to reforest federal lands with a focus on resilience. The strategy recommends that regional plans be developed to address reforestation backlogs and prioritize forests for future resilience. It places particular importance on reforestation in areas affected by fire and calls for reforestation projects that are science-driven, collaborative and designed to strengthen the national reforestation pipeline to meet broad-scale needs.

At the state level, new investments in reforestation have also occurred, with significant investments from the state legislature to update the Colorado State Forest Service nursery. Approximately $10.3 million has been appropriated for the Colorado State Forest Service to update their nursery facilities (House Bill 22-1323, House Bill 23-1060) with the intention of supporting reforestation efforts across the state and more broadly. The nursery upgrades, expected to be online in 2026, are anticipated to more than quadruple the Colorado State Forest Service nursery capacity. This strategy aligns with the 2020 Colorado Forest Action Plan by addressing the plan's goals to maintain forest as forest through encouragement of natural regeneration and planting, especially following disturbances, and increasing the pace of reforestation following disturbance to support watershed recovery (CSFS 2020).



II

Strategy development process

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American Forests partnered with the Arapaho and Roosevelt National Forests to collaboratively develop an all-lands, post-fire reforestation strategy to support landscape-scale recovery across the wildfire footprints of all wildfires that burned within the administrative boundaries between 2000 and 2020. The focal fires include the 2020 Cameron Peak, 2020 East Troublesome, 2020 Williams Fork, 2020 Calwood, 2018 Sugarloaf, 2017 Red Feather, 2012 High Park, 2011 Crystal, 2010 Fourmile Canyon, 2004 Picnic Rock, 2003 Overland, 2002 Unnamed, 2002 Big Elk and 2000 Bobcat fires (**Figure 1**).

This strategy focuses on all lands impacted by the focal fires, including lands burned within the Medicine Bow-Routt National Forest by the 2020 East Troublesome Fire, as it burned within the administrative boundaries of the Arapaho and Roosevelt National Forests. American Forests and the USDA Forest Service brought together a collaborative group of those with vested interests in functional forests across the landscape to build on other collaborative successes within the region to develop this strategy. Collaborators include the Colorado Forest Restoration Institute, Coalition for the Poudre River Watershed, City of Greeley, Colorado State Forest Service, Grand County, Larimer Conservation District, National Forest Foundation, Northern Water, Natural Resource Conservation Service and Rocky Mountain Research Station.

Between November 2023 and December 2024, the "Core Team" of partners convened to develop the post-fire strategy. The Core Team comprised members from the Arapaho and Roosevelt National Forests and Pawnee National Grassland, Colorado State Forest Service, Colorado Forest Restoration Institute, Rocky Mountain Research Station, Northern Water, Grand County, City of Greeley, National Forest Foundation, Coalition for the Poudre River Watershed, Larimer Conservation District and the Natural Resources Conservation Service. Meetings were held approximately once per month to develop the strategy.

The Northern Colorado Post-Fire Reforestation Strategy is intended to guide reforestation efforts across all ownership categories within the footprints of fires that have burned since 2000 within the administrative boundaries of the Arapaho and Roosevelt National Forests. The strategy also outlines a framework to address reforestation following future wildfires. This landscape-scale strategy is not intended to outline specific approaches to reforestation; instead, the strategy aims to provide a path forward for land-management agencies, community-connected partners, water providers and others as they build a robust and collaborative reforestation program to achieve a common vision for the post-fire landscape. Implementation planning will require clear articulation of desired conditions and measurable goals, field surveys, and appropriate adherence to jurisdiction-specific rules and regulations, (e.g., National Environmental Policy Act). The strategy is intended to be a living document that is updated once every three years to reflect accomplishments, incorporate changes to our understanding of the post-fire landscape, highlight changes to the reforestation pipeline, and update collaboratively derived action items that continue to facilitate implementation.

The strategy consists of the following components:

1. **Geospatial assessment** of post-fire reforestation opportunity — i.e., estimated acreage within the focal fire footprints that may need reforestation.
2. **Reforestation prioritization** to guide focused, collaborative and effective reforestation activities that will help achieve the vision and goals of this strategy as well as research needed to support implementation and improve management during a period of rapid environmental change.
3. **Reforestation pipeline assessment and scaling framework** that addresses estimated costs, funding, compliance, seed collection and storage, nursery capacity, workforce capacity, partnership expansion/development, and implementation approaches.
4. **Integration with land management policies and directives** (e.g., Forest Plan, Colorado State Forest Service 2020 Forest Action Plan), and ongoing planning efforts including fuel and watershed management.

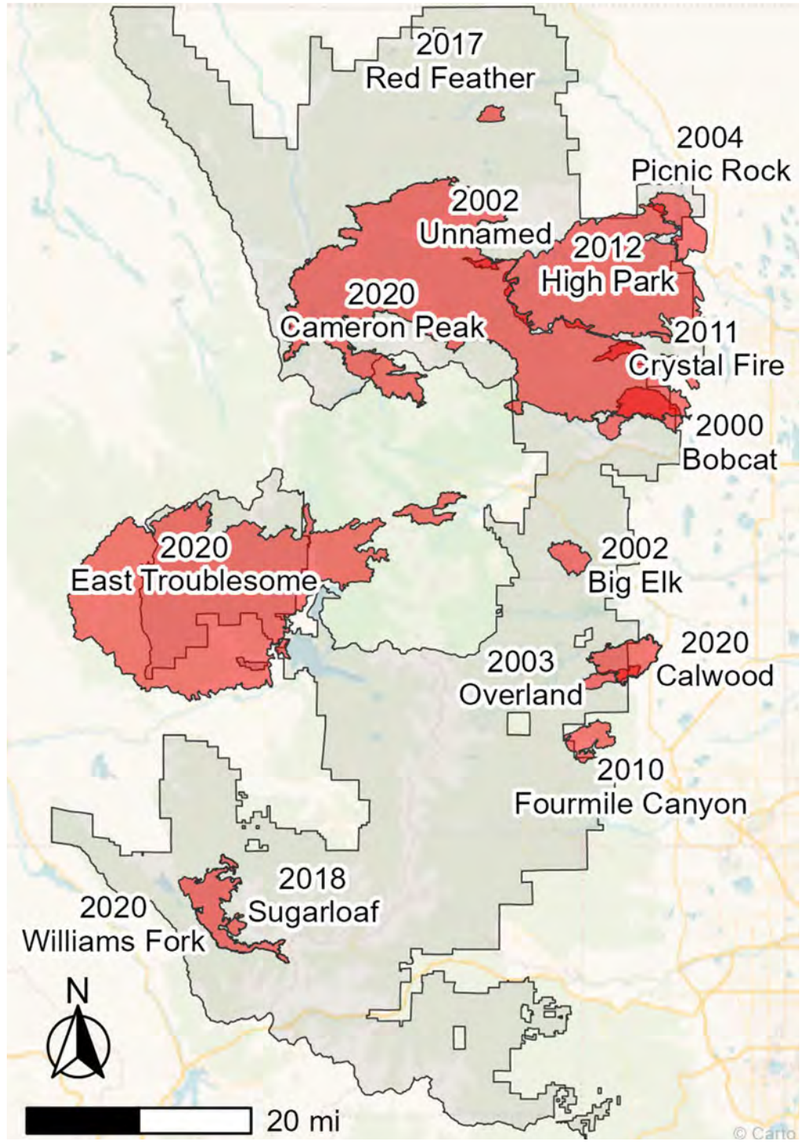

Figure 1

Wildfires that have burned across Northern Colorado are the focus of this reforestation strategy. For inclusion, wildfires must have burned within the administrative boundary of the Arapaho and Roosevelt National Forests, but the strategy encompasses all lands affected by the wildfire. The strategy encompasses a total of 14 wildfires that burned nearly 450,000 acres across Northern Colorado.

IV

Vision and goals

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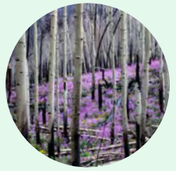
Vision

The Northern Colorado Post-Fire Reforestation Strategy envisions the recovery of post-fire landscapes and the development of future forests that are **resilient to wildfire, extreme conditions and other disturbances**. These forests will sustain **critical ecosystem services** essential for watershed function and community well-being. Implementation will integrate the **best available science** and a **resilient reforestation framework**, ensuring flexibility to respond to changing conditions. **Adaptive management** practices will be employed to secure short- and long-term success, with the goal of maintaining healthy forests over the next **10–50 years**.

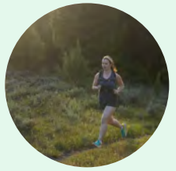
Critical ecosystem services

Water regulation
Promote upland canopy cover and soil health to enhance water timing, consistency and quality.

Flood and erosion control
Reduce soil erosion and stabilize soils.



Biodiversity support
Maintain genetic diversity and species richness across forest types.



Economic and recreational benefits
Support forest-based economies, including recreation and forest products.

Wildlife habitat
Create diverse terrestrial, riparian and aquatic habitats.

Climate regulation
Enhance local climate regulation and reduce invasive species.

Critical ecosystem processes

Nutrient and water retention
Enable forests, soils and watersheds to retain critical nutrients and water.

Biomass and carbon accumulation
Foster the accumulation of biomass and carbon sequestration in soils and vegetation.

Regeneration of forest cover
Ensure the regeneration of forest canopy and organic soil layers (litter/duff).

Fire regime management
Maintain appropriate fire regimes (frequency, intensity, severity) tailored to each forest type.

Landscape-scale heterogeneity
Restore forest structure and promote resiliency to future disturbance and ecosystem change.

Goals

1

Resilient forest recovery

- Support the recovery of resilient forests by applying adaptation frameworks for reforestation.
- Protect and restore seed sources in high-severity burn areas.
- Promote the re-establishment of seed sources to support natural regeneration following future disturbances.
- Foster integrated outcomes for plants, wildlife, clean water, recreation, economies and communities.
- Restore forest structure and composition that is ecologically appropriate for each forest type given present conditions and acknowledges the need to address management needs under future conditions.

2

Sustainable reforestation pipeline

- Develop a sustainable pipeline capable of addressing current and future reforestation needs by increasing seed collection, workforce and nursery capacities.
- Secure long-term funding sources beyond disaster relief.

3

Partnership and collaboration

- Expand partnerships to leverage resources and expertise, increasing operational efficiency across jurisdictions.
- Encourage collaboration with community-based partners to support reforestation activities.

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4 Adaptive management and monitoring

- Implement adaptive management practices to adjust strategies based on monitoring results.
- Increase research integration to address knowledge gaps and enhance reforestation success.

5 Integration with existing plans

- Ensure alignment of reforestation efforts with existing land management plans and strategies to achieve holistic landscape restoration.

6 Community engagement

- Generate community buy-in by developing an outreach strategy that incorporates public values and engages local communities.

V

Reforestation assessment

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Identifying planting opportunities

American Forests' analysts began by identifying the post-fire planting opportunity — i.e., areas within the wildfire footprints that are likely at risk of either regeneration failure or where regeneration is unlikely to happen over acceptable time frames (because it is difficult to differentiate between the two over short time periods following wildfire; Coop et al. 2020) and therefore would benefit from seedling planting to support post-fire forest recovery. Importantly, this initial assessment does not focus on policy or logistical constraints that may reduce the number of acres where planting may feasibly or legally occur, which is a subset of where regeneration may be less likely. We therefore defined the result of the following methods to be the "ecological planting opportunity." We incorporated logistical and policy constraints during the prioritization process. This initial look is intended to show where regeneration may be at risk across all fire footprints.

We initially estimated the post-fire planting opportunity using three distinct methods, all based on the same underlying processes. Post-fire regeneration is unlikely to occur in areas where severe crown fire consumes cones and the canopy seedbank, resulting in reduced seed availability for regeneration. Research has consistently shown distance to viable seed sources to be a predictor of post-fire regeneration (e.g., Stevens-Rumann and Morgan 2019, Davis et al. 2023). Additionally, the creation of large gaps by severe crown fire removes above-ground material, reduces climatic buffers and changes soil composition, further reducing regeneration probability (e.g., Cowan et al. 2016, Wolf et al. 2021). Therefore, areas across the fire footprints impacted by high-severity fire — a proxy for severe crown fire — were first identified, and second, areas within high-severity patches that were farther than 60 meters from the nearest potential seed source were identified. Sixty meters represents the median distance beyond which regeneration begins to decline across all species represented within the Southern Rocky Mountains in a recent review (Stevens-Rumann and Morgan 2019). Although seed dispersal may occur beyond 60 meters (Rodman et al. 2023), seed arrival does not necessarily mean regeneration will occur at sufficient densities to consider a forest recovered, especially under USDA Forest Service directives to maintain suitable forest cover. The threshold for seed dispersal distance was not modified to reflect dominant species or forest type, thereby avoiding unnecessary propagation of uncertainty in forest-type maps and complications associated with data resolution (30 meters) that limited the ability to account accurately for uncertainty and mapping errors.

Because the focus was on identifying areas where regeneration is likely to be impacted by wildfire effects, other causes of mortality, including mountain pine beetle, were not assessed. Additional reforestation activities to restore forests where large-scale mountain pine beetle outbreaks have occurred may be necessary but are outside of the scope of this strategy.

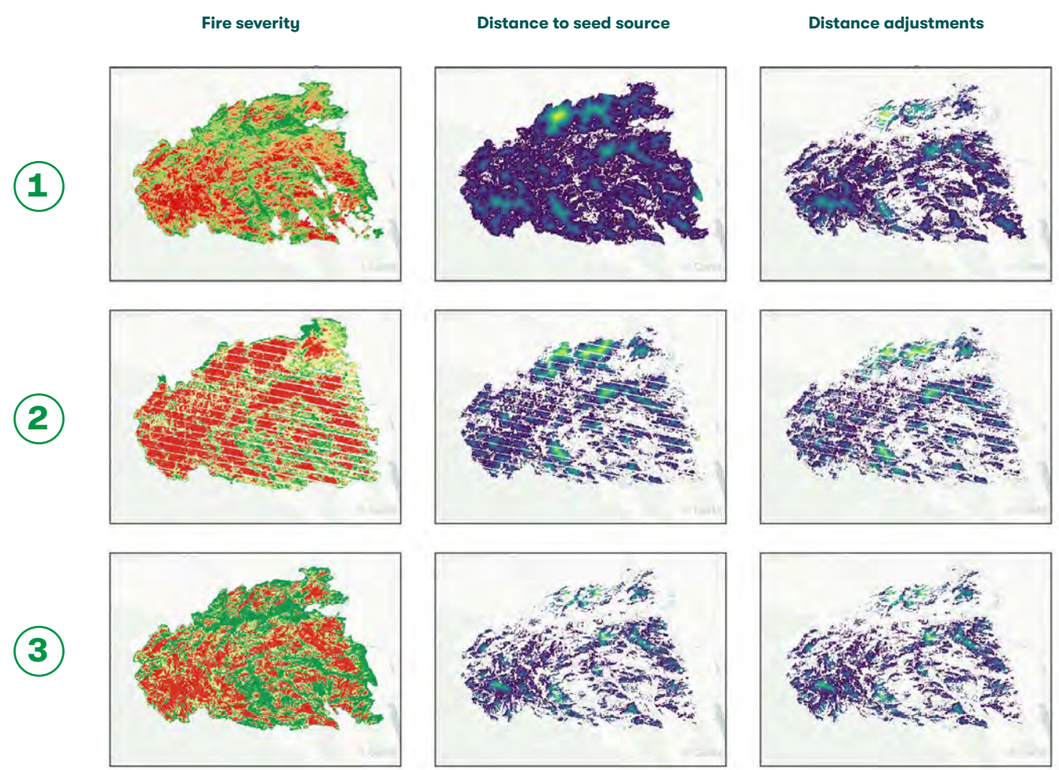
The outcomes of the three methods to identify areas within the fire footprints where natural regeneration was unlikely were assessed (**Table 1**):

1 **Modified Regenmapper approach**
Regenmapper (Holden et al. 2024) is a tool originally developed by Region 1 of the USDA Forest Service that identifies areas where regeneration is unlikely and prioritizes reforestation actions based on need. The webtool currently uses Monitoring Trends in Burn Severity (MTBS) fire severity maps to identify areas impacted by stand-replacing fire (moderate and high categories), and subsequently uses Global Ecosystem Dynamics Investigation (GEDI) canopy height to identify potential seed sources and other various sources to describe current climate conditions to apply a regeneration model developed by Davis et al. (2023) to define a natural regeneration probability surface for the fire footprint.

Because this model has not been validated, we identified areas that were classified as high severity by MTBS that were more than 60 meters from the nearest potential seed source (GEDI canopy height >5 meters; Potapov et al. 2021) as areas likely to experience delayed regeneration or permanent regeneration failure. These areas were therefore considered areas likely to need reforestation via seedling planting.

2 **Modified American Forests approach**
Pansing et al. (2023) identified post-fire planting opportunities (i.e., areas likely to require seedling planting that are at risk of delayed regeneration or permanent regeneration failure) across south central Oregon. They used Rapid Assessment of Vegetation Condition after Wildfire (RAVG) 7-class percent change in basal area (BA), considering any areas with >75% BA loss (class 6, class 7) to identify areas that burned at high severity. For this analysis, distance to nearest potential seed source was also calculated from the nearest pixel with a GEDI canopy height >5 meters to each pixel that burned at high severity. Pixels with distances >60 meters were identified as unlikely to recover (i.e., planting opportunity). However, because areas that were not previously forested were often included in the areas identified as a planting opportunity, the planting opportunity was masked with areas identified as previously forested according to the Rangeland Condition Monitoring Assessment and Projection layer (>10% canopy cover).

3 **Modified Rodman et al. (2022) approach**
Rodman et al. (2022) used a Google Earth Engine approach described by Parks et al. (2018) to identify areas impacted by high-severity fire (Relativized Burn Ratio (RBR) ≥ 283). High-severity areas >60 meters from the nearest potential seed source were identified as being at risk of delayed regeneration or permanent regeneration failure and therefore were considered a planting opportunity.



Method	Severity map source	Stand-replacing fire definition	Putative seed source data source	Available seed source definition	Additional step(s)
Regenmapper (modified) (Holden et al. 2024)	MTBS	"Moderate" and "High"	GEDI canopy height	Canopy height > 5 meters within unburned or low-severity burn areas	None
American Forests (modified) (Pansing et al. 2023)	RAVG 7-class percent change in basal area	BA loss >75%	GEDI canopy height	Canopy height > 5 meters within unburned or low-severity burn areas	Mask non-forest vegetation using LANDFIRE Biophysical Settings
Rodman et al. 2022 (modified)	Relativized Burn Ratio (RBR) with phenological offset	RBR ≥ 283	GEDI canopy height	Canopy height > 5 meters within unburned or low-severity burn areas	None

Table 1

Comparison of the initial methods considered to identify the planting opportunity across the post-fire landscape. These include modified versions of Regenmapper (Holden et al. 2024), the approach used in the Integrated Post-Fire Resilience Strategy (Pansing et al. 2023), and previous assessments of large wildfires in Northern Colorado (Rodman et al. 2022).

We then performed a limited validation process to gain basic insights into the performance of each approach, identifying areas using 2023 National Agriculture Imagery Program (NAIP) imagery across the fires that were impacted by stand-replacing fire and areas that were not. We found that the modified Rodman approach required the least post-processing and yielded the highest overall validation accuracy when identifying stand-replacing fire (94.9%; American Forests using RAVG=90.5%; RegenMapper using MTBS=88.1%). We therefore used the modified Rodman approach to identify the planting opportunity.

Once areas likely to be at risk of delayed regeneration or permanent regeneration failure (i.e., planting opportunity) were identified, areas that had been planted prior to the assessment were removed using data from the USDA Forest Service's Forest Activity Tracking System (FACTS), and with support from contributing partners who have reforested private

Owner	Planting opportunity (acres)	Percent of total planting opportunity
USFS - Arapaho and Roosevelt National Forests	138,741	72.7%
USFS - Medicine Bow-Routt National Forest	17,753	9.3%
Private	13,391	7.0%
National Park Service	12,788	6.7%
Bureau of Land Management	5,290	2.8%
City of Fort Collins	1,070	0.6%
Colorado State Land Board	937	0.5%
Boulder County	796	0.4%
Colorado Parks & Wildlife	68	<1%
Colorado State University	28	<1%
City of Greeley	14	<1%
TOTAL	**190,876**	**100%**

Table 2

Acres of planting opportunity and proportion of total planting opportunity by owner. This represents the total area identified within all fire perimeters that is at risk of delayed regeneration or regeneration failure. Wilderness and roadless areas and other land types that may not be reforested due to policy constraints have not been removed from these estimates. A total of approximately 12,000 and 26,000 acres are in federally designated Wilderness Areas within Rocky Mountain National Park and the Arapaho and Roosevelt National Forests, respectively. Additionally, 8,500 acres are withdrawn under the Forest Plan, and 8,400 acres are various combinations of non-forested, not available, not capable or not suitable.

lands in the area (Coalition for the Poudre River Watershed, Larimer Conservation District, Big Thompson Watershed Coalition). Patches of planting opportunity smaller than 25 acres were also removed to ensure that the spatial heterogeneity historically created by wildfires is maintained. Lastly, verification of pre-existing reforestation needs was conducted (e.g., timber harvest); no pre-existing reforestation needs had been documented in FACTS. These findings were corroborated by Regenmapper, which also identified no pre-existing needs.

Using the modified Rodman et al. (2022) approach combining stand-replacing fire identification (Parks et al. 2018) and GEDI canopy height >5 meters in unburned or non-stand-replacing areas within the fire footprint, we identified locations at risk of delayed regeneration or regeneration failure. The extent of these conditions across all wildfire footprints and jurisdictions was 190,876 acres, with 72.7% on Arapaho and Roosevelt National Forests lands, 9.3% on the Medicine Bow-Routt National Forest, and 7.0% on private lands (**Table 2**, see also **Appendix B** for breakdown by HUC8 watersheds).

It is important to note that the areas identified as a planting opportunity (i.e., at risk of delayed regeneration or permanent regeneration failure) are not guaranteed to require reforestation via seedling planting. There will be areas identified as a planting opportunity that will be regenerating naturally. Existing geospatial assessment methodologies are insufficient to move directly from assessment to implementation planning; geospatial analyses can only help identify areas where planting ***may*** be warranted.

Field verification is necessary to confirm that the need for artificial regeneration exists on the ground.

COLORADO STATE FOREST SERVICE

USDA Forest Service definitions and framework

Our approach to identifying the planting opportunity focused on identifying areas burned by the focal fires across all lands, regardless of ownership or policy restrictions that may limit seedling planting opportunities. However, the assessment above does not include forest management activities that may be necessary outside of areas identified as a planting opportunity. Because the USDA Forest Service must manage with an eye towards all of their lands, and there are areas where artificial regeneration is unlikely to occur due to policy constraints (i.e., Wilderness Areas), the planting opportunity analysis was expanded to ensure it can be useful to USDA Forest Service managers. Currently, guidance from Region 2 of the USDA Forest Service indicates that all areas within fire footprints should be categorized into one of three categories:

Certification of natural regeneration without site prep

Natural regeneration, sprouting or suckering are likely. Sites should be monitored for natural regeneration and will be planted later if necessary (FACTS code 4382)

Natural recovery

Not a reforestation need, mainly policy based, cannot be applied to suitable timber base, applies to Wilderness Areas (FACTS code 4453)

Plant trees

Areas where natural regeneration is unlikely and artificial regeneration (i.e., planting) may be needed (FACTS code 4431)

Categorization of the post-fire landscape into these three categories required the following:

1. **Planting opportunity** within the suitable timber base remained classified as plant.
2. **Planting opportunity** within inventoried roadless areas, Wilderness Areas, potential Wilderness Areas, wilderness study areas or areas otherwise outside of the current suitable timber base were reclassified to natural recovery.
3. **Areas that burned at moderate severity and are within the suitable timber base** — areas which were not included in the planting opportunity analysis above — were classified as certif ication of natural regeneration without site prep.
4. **Areas that burned at moderate severity that were outside of the suitable timber base** — areas which were not included in the planting opportunity analysis above — were classified as natural recovery.

All lands within the affected wildfire footprints on NFS lands were categorized into one of the three categories by National Forest and Forest District to facilitate planning by USDA Forest Service personnel. A total of 97,559 acres across NFS lands were categorized into the certification of natural regeneration category, 145,658 acres into the natural recovery category, and 118,054 into the plant category (**Table 3**). This includes lands on both the Arapaho and Roosevelt National Forests and the Medicine Bow-Routt National Forest.

Reforestation assessment

Activity		District Name	Acres
Certification of natural regeneration without site prep	Arapaho and Roosevelt National Forests	Boulder Ranger District	1,292
		Canyon Lakes Ranger District	53,279
		Sulphur Ranger District	27,917
	Medicine Bow-Routt National Forest	Parks Ranger District	15,071
Natural recovery	Arapaho and Roosevelt National Forests	Boulder Ranger District	1,038
		Canyon Lakes Ranger District	95,523
		Sulphur Ranger District	37,045
	Medicine Bow-Routt National Forest	Parks Ranger District	12,052
Plant trees	Arapaho and Roosevelt National Forests	Boulder Ranger District	2,447
		Canyon Lakes Ranger District	61,384
		Sulphur Ranger District	37,768
	Medicine Bow-Routt National Forest	Parks Ranger District	16,455

Table 3

Summary of reforestation acres on the Arapaho and Roosevelt National Forests and the Medicine Bow-Routt National Forest according to Region 2's Post-Disturbance Reforestation Assessment Considerations & Process document. The difference in acreage between the initial assessment of planting opportunity and what is shown in this table includes ~37,000.

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VI

Planting prioritizaion

Why develop a prioritization framework?

With nearly 191,000 acres of planting opportunity (i.e., areas at risk of delayed regeneration or regeneration failure) across all fire footprints and nearly 153,000 outside of Wilderness Areas, prioritization will be key to strategically scaling and deploying resources to maximize reforestation success, support ecosystem recovery and other benefits associated with forest cover

Developing an all-lands prioritization framework builds a cohesive foundation that supports sustainable landscape-scale forest restoration by identifying areas where planting success is likely and supports key ecosystem functions like water provisioning. Further, an all-lands approach can support cross-jurisdictional work by highlighting high-priority areas that cross jurisdictional boundaries to increase collaboration and move towards strategic landscape investments.

Prioritization process

The Core Team collaboratively developed a consistent and strategic prioritization framework for tree planting across the fire footprints. The Core Team identified a suite of categories and potential variables from each category considered significant to planting prioritization (**Appendix B**). American Forests then held individual conversations with Core Team members, facilitated group discussions and developed a survey that was distributed to Core Team members. Using survey data and information from the discussions, American Forests proposed a list of refined variables to guide prioritization. American Forests then developed a weighting framework for each of the variables based on a second survey sent to the Core Team. Each Core Team member provided their own weight for each of the final variables, and the final weights were determined by taking the median value from all responses for each variable and scaling them such that the lowest weight was set to one (**Table 4**). Weighted variable values were summed for each pixel, providing a raw weight. To categorize the priority values, we calculated the quartiles of the resulting raw values and categorized each pixel into “high” (75–100th percentile), “mid-high” (50–75th percentile), “mid-low” (25–50th percentile) and “low” (0–25th percentile) priorities.

Prioritization results

The Core Team identified the following variables to include in the prioritization framework: change in climatic moisture deficit (2041–2070 vs. 1981–2010), distance to seed source, change in maximum January temperature (2041–2070 vs. 1981–2010), topographic wetness index (TWI), heat load index (HLI), water storage (reservoir/lake) within a HUC12 watershed, water structures within a HUC12, and riparian areas within a HUC12.

Change in climatic moisture deficit

(2041–2070 vs. 1981–2010)

Climatic moisture deficit (CMD) was used to identify areas where the chance of seedling survival is highest and the probability of seedling planting success is increased based on current and future site moisture. Climactic moisture deficit has been shown to affect both planted and natural seedling survival, and these effects are expected to become more pronounced in arid areas as observed temperatures increase and droughts become more common. Studies to date have shown that higher CMD (i.e., warmer, drier locations) is detrimental to seedling survival, whether planted or natural, and that survival increases in wetter, cooler areas (Stevens-Rumann et al. 2017, Davis et al. 2023, Marshall et al. 2024, Rodman et al. 2024). To incorporate these considerations, we took the difference between CMD during the historical period 1981–2010 and CMD projected during the period 2041–2070 (AdaptWest Project 2022, Wang et al. 2022). Raw data are at 1-kilometer resolution, which was resampled to 30 meters using bilinear interpolation. Change in CMD generally follows patterns of current CMD, with higher elevation locations — which tend to be cooler and wetter — having lower difference in CMD, suggesting these areas are likely to be more suitable for seedling survival now and in the future. For prioritization lower changes in CMD were more highly prioritized.

Distance to seed source

Distance to seed source remains one of the most highly researched variables that show time and again in the Southwest a negative relationship with post-fire regeneration (Stevens-Rumann and Morgan 2019, Chambers et al. 2016). Because areas within the core of high-severity burned patches are least likely to receive seed input, the priority of areas was increased with distance to seed source. This ensures that reforestation activities are likely to target areas within the core of large patches with near-complete tree mortality.

Within areas mapped as high severity using RBR calculated in Google Earth Engine (see Parks et al. 2018), we calculated the distance in meters to the nearest pixel mapped as unburned, low- or moderate-burn severity with an estimated canopy height of at least 5 meters. Canopy heights were provided by data from (Potapov et al. 2021) who used GEDI spaceborne lidar and Landsat to estimate canopy height circa 2019. All data acquisition and processing were done on Google Earth Engine. Although this variable was used to identify areas potentially at risk of delayed regeneration or regeneration failure, it did not account for the reduced probability of seed arrival as distance to potential seed source increases. Therefore, larger distances to potential seed sources were given higher priorities due to reduced probability of seed arrival.

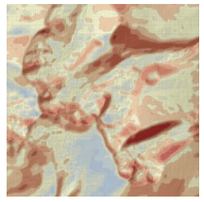
Change in maximum January temperature

(2041–2070 vs. 1981–2010)

Emerging CFRI monitoring data of planted seedlings is showing seedling vulnerability to winter mortality, especially in Ponderosa pine (Chambers et al. 2024). This is potentially due to a lack of seedling insulation provided by snow due to decreasing snow cover, and/or increasing moisture stress associated with lack of snow cover (Frey 1983), which can potentially act as positive feedback in wildfire footprints as wildfire areas can have advanced snow-free timing caused by more positive net shortwave radiation balance, impacting both survival during cold periods and water availability later in the season (Kampf et al. 2022). Because we anticipate these changes to become exacerbated by increasing temperatures and drought conditions, we looked at the difference between January maximum temperature during the historical period (1981–2010) and the future scenario (2041–2070) (AdaptWest Project 2022, Wang et al. 2022). Raw data are at 1-kilometer resolution, which we resampled to 30 meters using bilinear interpolation. We prioritize lower changes in January maximum temperature, which are likely to facilitate better seedling survival because of continued snow cover.

Topographic wetness index

Topographic wetness index (TWI) measures relative site moisture based on topography and has been linked to seedling survival at fine scales, with higher TWIs identifying potential microsite conditions associated with increased seedling survival (Marsh et al. 2022). A 10 meter U.S. Geological Survey (USGS) digital elevation model (DEM) (https://apps.nationalmap.gov/downloader/; Accessed September 2023) was used to calculate TWI using System for Automated Geoscientific Analyses (SAGA; version 8.4.1; Conrad et al. 2015) in conjunction with the 'RSAGA' package in R (Brenning et al. 2022). The SAGA output for TWI was smoothed using a focal (3x3) mean filter. Values greater than 14.4 were omitted because they overlapped with riparian areas and open water. We resampled the data (10-meter resolution) to 30 meters using bilinear interpolation.



Heat load index

Heat load index (HLI) measures solar heating, which can negatively impact seedling survival (Rodman et al. 2020, Marsh et al. 2022). Because higher HLIs are associated with lower seedling survival, we prioritized areas with lower HLI. We used a 10-meter USGS DEM (https://apps.nationalmap.gov/downloader/; Accessed September 2023) and calculated HLI using the 'spatialEco' package in R (Evans et al. 2023). This output was then smoothed using a focal (3x3) mean filter. We then resampled the data (10-meter resolution) to 30 meters using bilinear interpolation.

Water storage (reservoir/lake)

Wildfire significantly impacts water provisioning via increased sedimentation, altered water chemical composition including increased toxins, and increases in runoff and erosion. Sedimentation can be particularly harmful for reservoirs, decreasing storage capacity, increasing nutrient and contaminant loads, reducing reliability for downstream uses including drinking water, and affecting costs associated with dredging and necessary repairs to infrastructure, the effects of which can persist for many years (e.g., Rhoades et al 2019, Lynch 2004). Long-term forest recovery and therefore reforestation are associated with multiple long-term benefits for water provisioning, including increased wood recruitment to rivers, thereby restoring fluvial complexity and associated water retention and nutrient cycling ecosystem services that support water quantity and quality. We therefore prioritized areas with proportionally more area covered by reservoirs and lakes to support hydrological

recovery. We calculated the area of each HUC12 watershed that is covered by water bodies (either reservoir or lake). Data were then log-transformed to reduce skewness, with watersheds having less than 1 acre of storage being set to 0. All data were acquired from the USGS (https://www.usgs.gov/national-hydrography/access-national-hydrography-products; Accessed April 2024).

Water structures

Similarly, erosion, high runoff and debris flows have the potential to damage key water structures important for water provisioning. To reduce the risk of long-term consequences to these structures, we prioritized HUC12 watersheds that contained more water structures. The structures within each HUC12 watershed were counted, and data were log-transformed to reduce skewness, with watersheds having no structures being set to 0. Structures were acquired from the Colorado Department of Water Resources (https://dwr.colorado.gov/services/data-information/gis; Accessed April 2024). At-risk structures comprised those with a "Feature type" including "Point of diversion," "Other," "Headgate," or "Dam (above outlet)," and a "Structure type" including "Ditch," "Reservoir system," "Pipeline, reservoir or other." These decisions were made with the help of the City of Greeley.

Riparian areas

Lastly, HUC12 watersheds with more acres of riparian areas were prioritized, allowing increased focus on areas where there is likely to be substantial impact on the hydrological cycle within the fire footprints. The acres of riparian areas (using 50-year flood height) within each HUC12 watershed were calculated, where more acres were given a higher priority. Riparian data was obtained from Abood et al. (2022; Accessed March 2024).

Prioritization variable	High priority	Weight (Median-scaled response from Core Team members)
Change in CMD (1981-2010) vs. (2041-2070)	**Lower change in CMD**	**2.93**
Distance to nearest potential seed source	**Larger distance**	**2.89**
TWI	**Higher TWI**	**2.78**
Change in January maximum temperature (1981-2010) vs. (2041-2070)	**Lower change in January maximum temperature**	**2.37**
HLI	**Lower HLI**	**1.98**
Water storage	**Larger areas**	**1.60**
Riparian areas	**Larger riparian areas**	**1.23**
Water structures	**More water structures**	**1**

Table 4

Prioritization variables and variable weights as selected by the Core Team. Higher variable weights represent higher values of that variable.

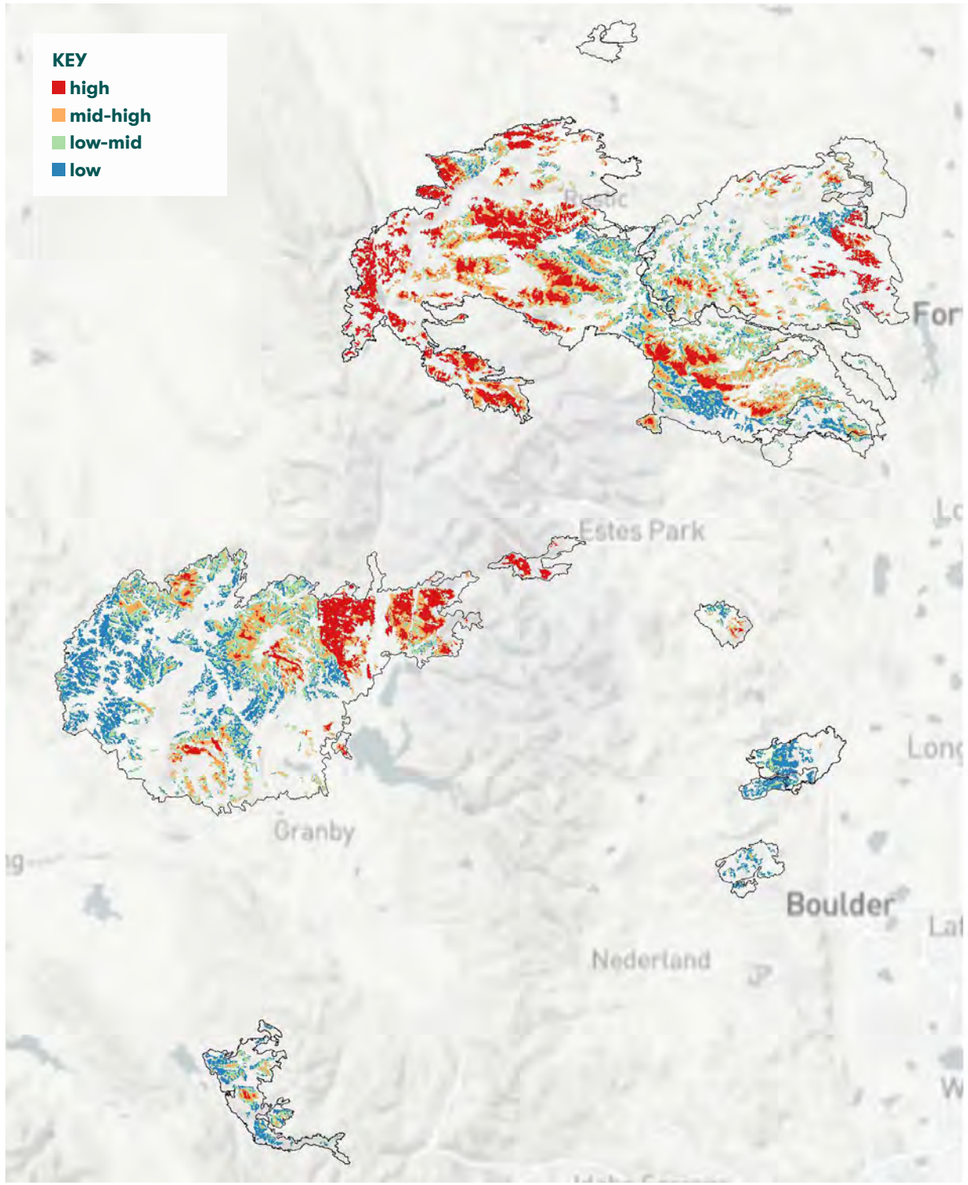


Figure 2

Map illustrating planting priorities weighted by the Core Team. Planting priorities were assigned using a suite of eight variables including change in CMD 2041-2070 – 2981-2010, distance to nearest seed source, change in January Temperature 2041-2070 – 2981-2010, TWI, HLI, water storage, riparian areas and water structures. Variables were weighted based on Core Team input and categorized using quartiles.

The resulting prioritization map after categorizing each pixel is shown in **Figure 2**. Most high-priority areas fall along the Continental Divide, as these areas are projected to be less impacted by increasing temperatures and drought (i.e., lower change in CMD and lower change in maximum January temperature; AdaptWest Project 2022) and also are key areas for watershed provisioning (e.g., Upper Colorado Headwaters watershed).

A few caveats to note for this prioritization process. First, variables were required to have a geospatial layer with complete coverage across the entire extent of the area covered by the focal fires. Although there are many datasets that could have supported prioritization at local scales (e.g., priority watersheds within the Cache la Poudre watershed), including these local data layers would result in inconsistent prioritization across the focal fires. We recognize there may be relevant local information that can support prioritization at a local scale, and we encourage local decision makers to consider additional information when identifying areas to address first. Further, this process was intended to prioritize planting areas not only based on available research about seedling survival and establishment, but also based on community values, ecosystem services and social concerns. Science can tell us what impacts post-fire regeneration and planting success, but it cannot tell us how to value those aspects that may influence our decisions. For example, science indicates natural regeneration and seedling survival may be reduced under future conditions (e.g., Davis et al. 2023, Crockett and Hurteau 2024); however, whether managers prioritize planting seedlings in future high-risk areas or choose to deprioritize them is a value judgement. Similarly, prioritization of watersheds with water bodies to increase the amount and reliability of drinking water supplies is a social concern, not one based on best approaches for ecosystem health and function.

Accessibility and policy constraints

Reforestation activities are realistically contained by logistics and policy. We therefore restricted planting areas based on common logistical and policy constraints to better understand where planting activities are likely to occur. Across NFS lands, most planting activities take place in areas with limited slopes that are accessible from roads. After discussions with the USDA Forest Service staff, we constrained planting areas to those with a slope <60% and no more than 1.5 miles from the nearest road.

From a policy perspective, we removed all identified planting areas that fall within Wilderness Areas or the non-suitable timber base. In these areas, planting may be prohibitively challenging or impossible due to additional compliance requirements and social acceptance.

Lastly, we identified areas that were within 250 feet of a Potential Operational Delineation (POD) boundary. These planning units, which have been defined for more than 40 national forests, are characterized by landscape features that can act as containment lines and within which landscape characteristics can be identified to outline fire-management objectives and approaches. Because POD boundaries are intended to be control lines, planting approaches may need to be modified (e.g., shaded fuel breaks) to facilitate future wildfire management. We highlighted these areas to encourage mindful integration of reforestation and wildfire management. The final prioritization map that includes policy and access constraints is shown in **Figure 3**.

On Arapaho and Roosevelt National Forests, 67.8% of the identified planting opportunity falls within accessible areas with no policy constraints. Nearly 21,000 acres of the accessible area with no policy constraints were identified as a high-priority planting area (**Table 5**). In contrast, nearly 15,000 acres identified as high priority for planting falls in areas including the Comanche Peak and the Rawah Wilderness Areas that present hurdles for planting. On the Medicine Bow-Routt National Forest, only 4,000 acres of the planting opportunity are accessible or have no policy constraints, only 13 acres of which are high-priority. In contrast, nearly 14,000 acres fall into areas including the Troublesome South Roadless area that overlaps with the western portion of the East Troublesome Fire. However, nearly 11,000 of these acres are low priority for planting. Private lands have no policy constraints and, therefore, are less limited as constraints represent accessibility concerns only.

COLORADO STATE FOREST SERVICE

Planting opportunities within Wilderness Areas

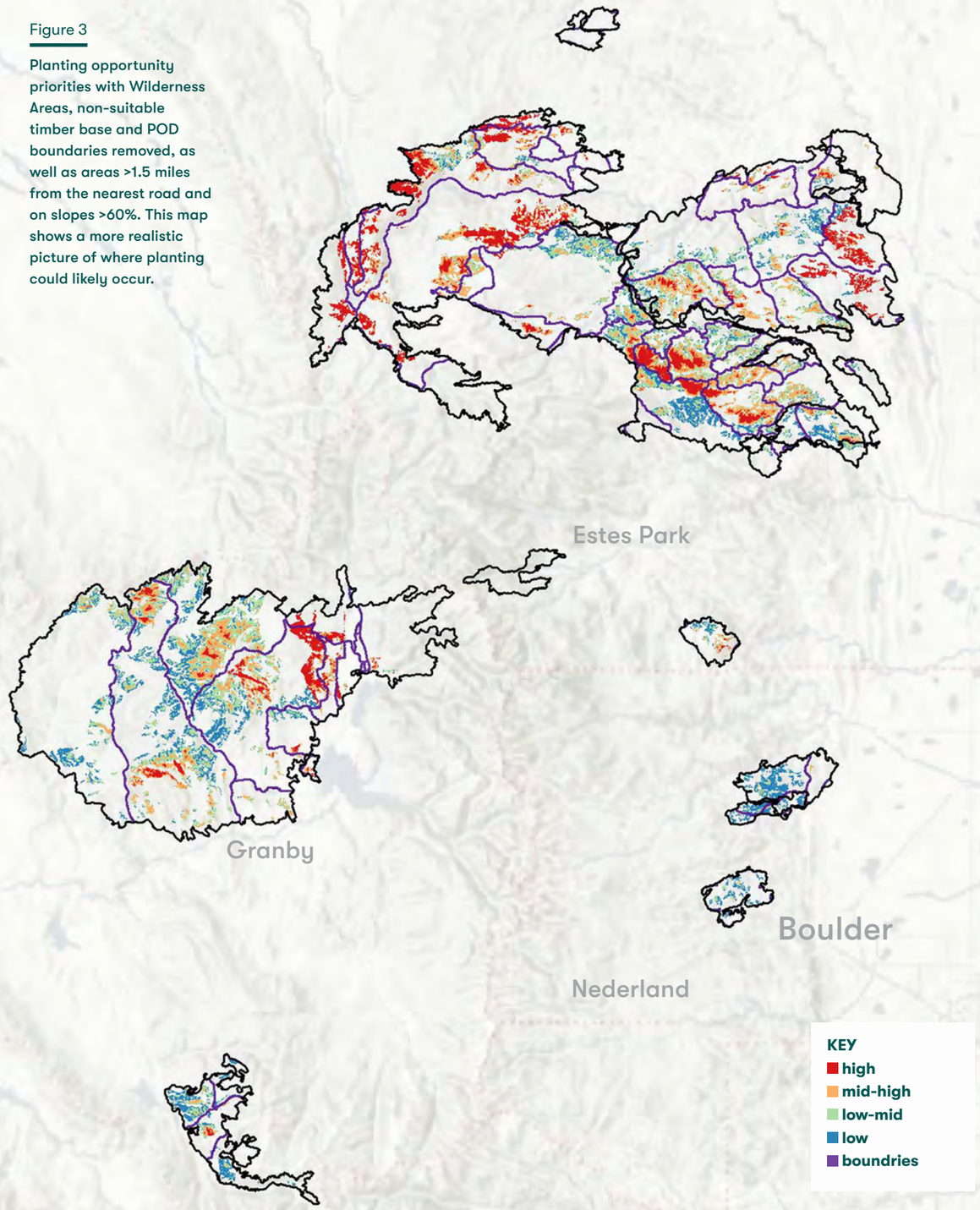
Landowner	No policy or logistical constraints				No policy or logistical constraints AND within 250 feet of a POD boundary				Policy and/or logistical constraints			
	High	Mid-High	Mid-Low	Low	High	Mid-High	Mid-Low	Low	High	Mid-High	Mid-Low	Low
City of Fort Collins	348	256	267	180	0	0	0	0	10	0	2	6
City of Greeley	0	1	6	7	0	0	0	0	0	0	1	0
Colorado Parks & Wildlife	21	14	2	0	0	0	0	0	22	9	0	0
Colorado State Land Board	146	287	304	123	5	34	18	1	4	0	9	7
Colorado State University	4	21	2	0	0	0	0	0	0	0	0	0
National Park Service	67	94	66	15	25	13	2	0	6,902	4,416	1,062	125
Private	3,377	2,509	3,263	3,264	81	75	118	84	162	71	148	240
U.S. Bureau of Land Management	147	1022	1,327	1,423	1	4	1	0	32	602	550	182
Arapaho and Roosevelt National Forests	20,799	24,776	25,732	21,648	941	908	1,019	693	14,581	11,458	9,729	6,458
Medicine Bow-Routt National Forest	13	439	1,658	1,977	0	12	51	17	31	661	2,359	10,534
TOTAL	24,922	29,453	32,647	29,359	1,053	1,046	1,209	795	21,744	17,220	13,862	17,566

Table 5

Acres of planting opportunity by priority (high, mid-high, mid-low, low), owner and whether the planting opportunity is constrained by logistical concerns — i.e., is >1.5 miles from the nearest road or on a slope >60%, and/or policy concerns — e.g., is within a federally designated Wilderness Area, or non-suitable timber area, and/or within 250 feet of a POD boundary.

Figure 3

Planting opportunity priorities with Wilderness Areas, non-suitable timber base and POD boundaries removed, as well as areas >1.5 miles from the nearest road and on slopes >60%. This map shows a more realistic picture of where planting could likely occur.



VII

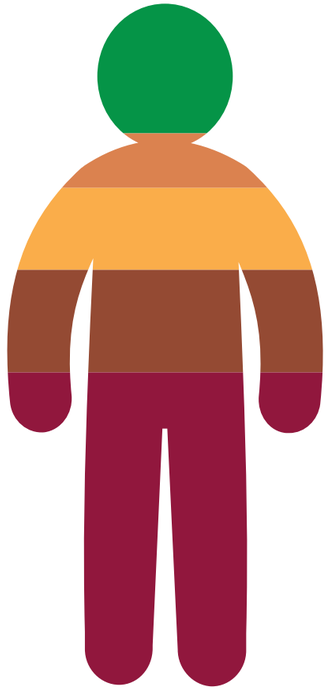
Reforestation pipeline

Reforestation pipeline survey

To better understand the current and potential capacity of the pipeline to support reforestation in Northern Colorado, the Core Team developed a capacity survey that was sent to 50 organizations that support reforestation or ecosystem health across the region (e.g., nurseries, community connected partners, government entities). Survey questions covered the range of activities associated with the reforestation pipeline from nursery cone collection to seedling production, planting and monitoring capacity (See survey questions in **Appendix C**). We received responses from 26 organizations and collated them to better understand current reforestation capacity and interest, as well as the ability to expand reforestation capacity in the future.

Reforestation pipeline survey results

1. Respondent profile



ORGANIZATION CATEGORIES

- **5** Government entities (Federal, State, County, City) (19%)
- **2** Other NGOs (8%)
- **3** Utilities (12%)
- **4** Research/research and policy (15%)
- **12** Community-connected partners (46%)

CURRENT AND FUTURE ROLES

The survey identified that organizations play multiple roles within the reforestation pipeline, with significant engagement in:

CURRENT ROLES

- Coordination, implementation and monitoring roles are most common
- Only three organizations are currently involved in nursery operations
- 21 organizations are involved in some implementation or monitoring activities

FUTURE ROLES

- More organizations plan to add nursery and seed-related functions
- Several organizations anticipate expanding their role in future reforestation efforts
- Five organizations intend to include nursery operations in their future roles (up from 3)

2. Nursery production capacity

CURRENT CAPACITY

- **Container capacity:** 1,840,000 seedlings total among reporting nurseries
  - **Average:** 613,333 seedlings per nursery
  - **Range:** 240,000–1,000,000 seedlings
- **Container production:** 840,000 seedlings currently produced
  - **Average:** 280,000 seedlings per nursery
  - **Utilization rate:** ~46% of total capacity
- **Bare root capacity:** 1,800,000 seedlings total
  - **Average:** 600,000 seedlings per nursery
- **Bare root production:** 140,000 seedlings currently produced
  - **Utilization rate:** ~8% of bare root capacity

CAPACITY SUFFICIENCY

- All three nursery providers indicated **current capacity is insufficient** to support current reforestation needs
- Only 1 of 3 providers indicated future capacity would be sufficient to support reforestation needs
- 2 of 3 nurseries have planned expansions (targeted for 2025 and 2028)

46%

of total container capacity is currently utilized.

8%

of total bare root capacity is currently utilized.

All three nursery providers indicated **current capacity is insufficient** to support current reforestation needs.

3. Seed processing and storage capacity

CURRENT SEED PROCESSING CAPABILITIES

- **Seven organizations** (27%) reported having seed storage capacity
- **16 organizations** (62%) have no seed storage capability
- Limited data was reported on extraction and processing capacity metrics

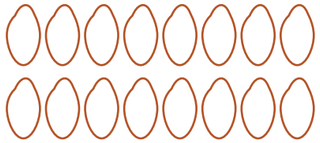
SEED COLLECTION ACTIVITIES

The survey revealed varied experiences with seed collection:

- Multiple organizations reported surveying for cone availability
- Several organizations mentioned reliance on volunteers for collection
- **Key challenges included:** finding good cone locations, timing collection with cone ripeness, and limitations on access to public lands

CURRENT SEED PROCESSING CAPABILITIES

7 organizations reported having seed storage capacity



16 organizations reported having **no** seed storage capability

Sample response:

"We checked for cone ripeness and collected cones in the backcountry and wilderness for the U.S. Forest Service. Targeted species were limber pine and bristlecone. Our volunteer organization is unique because we utilize horses to reach otherwise inaccessible areas, which ultimately allows us to carry more cones and increase genetic diversity throughout nurseries."

4. Planting and monitoring activities

PLANTING OPERATIONS

- **Average acres planted:** Median of 0 acres planted per organization, mean of 11,798 acres per organization (ranging from 0–200,000)
- **Maximum acres planted:** Median of 0 acres planted per organization, with a mean of 39,272 acres per organization (ranging from 0–500,000)
- Most respondents are **not** actively involved in planting. Approximately **five** organizations account for all acres planted by survey respondents

MONITORING ACTIVITIES

- **Average acres monitored:** 4 acres per organization
- Several organizations noted monitoring focuses primarily on survival rates rather than comprehensive research
- Limited monitoring capacity was cited by multiple respondents

11,798

mean number of acres per organization (ranging from 0–200,000)

COLORADO'S COALITION FOR THE POUDRE RIVER WATERSHED

COLORADO STATE FOREST SERVICE

5. Workforce capacity

CURRENT STAFFING

- **Total full-time equivalents (FTEs):** Median of 0 FTEs per organization and a mean of 4.4
- **Total workforce among all responding organizations:** 92.25 FTEs
- Eight organizations (36%) employ seasonal staff for reforestation activities
- **Seed FTEs:** Average of 1.7 FTEs dedicated to seed-related activities

WORKFORCE BOTTLENECKS

Major constraints included:

- Limited funding for dedicated reforestation staff
- Competition with other organizational priorities
- Lack of specialized training in reforestation practices
- Challenges in recruiting qualified seasonal workers

36%

of organizations employ seasonal staff for reforestation activities

6. Funding landscape

CURRENT FUNDING SOURCES

- 14 organizations (58%) reported having funding sources
- 10 organizations (42%) reported no dedicated funding

ORGANIZATIONS MENTIONED RECEIVING FUNDING FROM DIVERSE SOURCES

- Federal sources (USFS infrastructure funding, USBR WaterSmart)
- State agencies (Colorado Department of Public Health and Environment)
- Private foundations (Grand Foundation, Windy Gap Environmental Fund)
- Corporate partnerships (New Belgium Brewing)
- Donations and specialized funds (Emergency Wildfire Fund)

58%

of organizations reported having funding sources.

FUNDING BOTTLENECKS

Key funding challenges included:

- Limited staff capacity to apply for and manage grants
- Matching requirements for federal grants (e.g., 35% match for USBR)
- Restricted funds that don't cover implementation labor
- Competing organizational priorities
- Limited funding opportunities specifically for reforestation

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7. Key bottlenecks across the reforestation pipeline

NURSERY BOTTLENECKS

- Limited infrastructure for expansion
- Property access and space constraints
- Seasonal variation in cone production, leading to inconsistent collection

SEED COLLECTION BOTTLENECKS

- Access limitations to collection sites
- Unpredictable cone crops
- Shortage of trained climbers/collectors
- Labor costs for collection activities
- Limited funding for collection operations

PLANTING BOTTLENECKS

- Workforce capacity constraints
- Access to remote planting sites
- Limited funding for implementation
- Reliance on volunteers
- Seasonal timing constraints

MONITORING BOTTLENECKS

- Lack of dedicated monitoring staff
- Knowledge gaps in monitoring protocols
- Funding limitations for long-term monitoring
- Competing organizational priorities

WORKFORCE BOTTLENECKS

- Limited capacity to manage multiple projects
- Skill gaps in specialized reforestation practices
- Geographic distribution of available workforce
- Organizational mission constraints

FUNDING BOTTLENECKS

- Uncertainty about available funding sources
- Administrative burden of grant management
- Match requirements for federal funding
- Short funding cycles versus long-term needs

2 nurseries are planning expansions

8. Future capacity direction

Organizations reported various approaches to increasing their capacity:

CURRENT FUNDING SOURCES

- Post-fire recovery funds and RTRT funds
- NRCS, CSFS and CWCB
- The Nature Conservancy and Northern Colorado Community Foundation
- Private donors and water providers
- Corporate partnerships

PLANNED EXPANSION

- Two nurseries planning expansions (in 2025 and 2028)
- Several organizations exploring expansion into new roles
- Potential for increased partnerships across the reforestation pipeline
- Improving coordination across the reforestation pipeline

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Conclusion

Overall, survey results indicate a growing but constrained reforestation capacity in Northern Colorado. Although the surveyed organizations are actively engaged across the reforestation pipeline, significant bottlenecks exist in nursery production, seed collection, workforce capacity and funding. Future efforts to scale reforestation will need to address these constraints through expanded partnerships, diversified funding sources, and increased investment in infrastructure and workforce development.

KEY OPPORTUNITIES FOR IMPROVEMENT INCLUDE

- Developing dedicated funding streams for reforestation implementation
- Building partnerships that leverage complementary organizational strengths
- Expanding nursery production capacity to meet future demands
- Investing in workforce development and specialized training

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...strong relationships and fruitful partnerships have emerged in some locations across the focal fire footprints...

Seed inventory

Seed inventory on the Arapaho and Roosevelt National Forests is severely lacking. Some seed zones and elevation bands have already been depleted, and the remaining inventory is nearing its shelf life. Assuming that all seeds could be used for reforestation, the forest currently has enough seeds to reforest ~11,700 acres. Focusing on breeding zone, if we assume that all seeds can be used regardless of species mix, the percent planting opportunity acres that could be reforested to appropriate stocking densities would range from 6.25–100%. If all of the current inventory were used regardless of species mix, a median of 6.25% of the planting need could be reforested in each breeding zone.

Reforestation workforce capacity

Workforce capacity on private lands

Given the often-small acreage, expense and lack of resources available, private landowners face a multitude of challenges when reforesting their lands. Luckily, strong relationships and fruitful partnerships have emerged in some locations across the focal fire footprints that have successfully supported reforestation on private lands.

For example, the Coalition for the Poudre River Watershed, a Core Team member whose mission is to "improve and maintain the ecological health of the Poudre River watershed through community collaboration," The Nature Conservancy, and other community-connected groups have worked tirelessly across the Cameron Peak and High Park Fire footprints to identify landowners with interest in reforestation, build meaningful relationships with those landowners, develop reforestation plans, convene volunteer plantings, and continue to monitor seedling survival and growth over time (CPRG 2023). Their collaborative efforts and successful outreach have resulted in over 35,000 seedlings planted on private lands across two watersheds heavily impacted by wildfire.

However, other regions of the focal landscape are limited in their partnerships, and reforestation on private lands has moved more slowly. On the west side of the Continental Divide in areas impacted by the East Troublesome Fire in particular, additional support and development of the limited capacity for reforestation on private lands is needed. It will be imperative to build partnerships with the few existing groups in the region, leverage outreach opportunities from state, local and federal partners, or more realistically, a combination approach.

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Strategic goals

Forging an actionable path to a forested future

This Reforestation Strategy Action Plan outlines a structured approach to increase the pace and scale of reforestation activities across all land ownerships in Northern Colorado, bolstering capacity to restore forest ecosystems, increasing forest resilience, promoting biodiversity and supporting sustainable forest-management practices. Given the urgent need to ramp up reforestation across the landscape, this plan identifies key requirements to strengthen our reforestation pipeline, improve seed sourcing and storage, build partnerships, expand our skilled workforce, and take steps towards improving implementation to ensure forest resilience. By implementing this plan, the Core Team aims to create healthy, disturbance-resilient forests that can sustain ecological functions, sequester carbon and provide critical habitats for wildlife. Importantly, this plan is meant to be iterative and should be updated over time to ensure that next steps are aligned with the changing landscape of needs, shared capacity and integration with other forest-management initiatives.

Strategic Goals

1

Increase the pace and scale of reforestation by addressing reforestation pipeline constraints

Seed supply, workforce capacity and infrastructure are significant challenges to meeting reforestation needs across Northern Colorado. As local, regional and western reforestation initiatives expand, demand for these resources will likely strain current capacity (e.g., Fargione et al. 2021, Dobrowski et al. 2024). Collaborative solutions tailored to Northern Colorado will be crucial for effective reforesting and restoring the fire-affected landscapes covered in this strategy, as well as addressing any reforestation generated by future wildfires.

1.1

Overarching Task

Develop a Reforestation Collaborative to devise additional solutions to pipeline challenges

Convene all reforestation partners to leverage existing relationships and successes in the region and devise strategic and actionable paths forward to support and expand the reforestation pipeline.

SPECIFIC ACTION 1.1.1

Develop a scope of work and funding strategy for a reforestation pipeline focused collaborative

Set the stage for the successful development of a collaborative group focused on addressing reforestation pipeline challenges across all sectors and land bases in Northern Colorado.

Action Steps

1. Identify a Planning Committee
   - **Description**: Develop a list of partners interested in helping to scope, find funding for and launch a collaborative focused on bolstering the reforestation pipeline
   - **Expected outcomes**: At least three identified partners with capacity and interest to support planning for the collaborative
   - **Responsible parties**: Colorado Forest Restoration Institute, The Nature Conservancy, Colorado State University Extension Jefferson County, American Forests, with others to be added as needed
   - **Timeline**: March 2026
2. Develop a scope of work for the collaborative
   - **Description**: Create the vision and purpose for the collaborative including potential structure, timelines and funding needs
   - **Expected outcomes**: A clear scope that can support collaborative development and funding searches
   - **Timeline**: April 2026
3. Develop a budget for the collaborative
   - **Description**: Develop a budget to better understand funding needs and next steps necessary to launch the collaborative
   - **Expected outcomes**: Clear budget with assignments to particular organizations for specific deliverables
   - **Timeline**: April 2026

1.2

Overarching Task

Strengthen and expand opportunities for community-connected partners to support reforestation activities on NFS lands

Long-term reforestation success across all lands, and NFS lands in particular, will be contingent upon collaboration and cross-boundary partnerships to support key activities, expand capacity and promote awareness of actions and progress.

SPECIFIC ACTION 1.2.1

Develop National Forest Foundation grants for community-connected partners to support reforestation on NFS lands

See **Actions 1.3.1** and **1.3.4**

SPECIFIC ACTION 1.2.2

Develop opportunities for volunteer plantings on NFS lands

Volunteer plantings, while often small in size, can have outsized impact on community perceptions of progress and work on NFS lands, as well as provide community-connected partners a venue to contribute to work on those lands, providing education and outreach necessary for community buy-in.

Action Steps

1. **Collaborate with the Arapaho and Roosevelt National Forests to identify and plan volunteer-planting opportunities on NFS lands**
   - **Description**: Community-connected partners will work with the Arapaho and Roosevelt National Forests staff to identify planting units with areas that may support volunteer plantings
   - **Expected outcomes**: List of reforestation project characteristics and/or potential planting units that may support volunteer plantings
   - **Responsible parties**: American Forests, National Forest Foundation, Arapaho and Roosevelt National Forests
   - **Timeline**: January 2026
2. **Identify interested community-connected partners**
   - **Description**: Conduct outreach to community-connected partners who work within the fire perimeters with interest in conducting volunteer planting on NFS lands
   - **Expected outcomes**: At least three partners identified with capacity and interest to conduct volunteer plantings on NFS lands
   - **Responsible parties**: American Forests
   - **Timeline**: January 2026
3. **Identify planting units suitable for volunteer engagement**
   - **Description**: ARP and interested parties will collaborate to identify planting units and areas within planting units best suited to support volunteer-planting events
   - **Timeline**: April 2026
4. **Launch volunteer plantings**
   - **Timeline**: Summer 2027

1.3

Overarching Task

Increase seed collection on NFS lands

Increase activities associated with seed collection to ensure collection can occur when seed crops are produced and that anticipated seed needs are met.

SPECIFIC ACTION 1.3.1

Develop a seed survey and monitoring workforce by developing a seasonal workforce managed by various community-connected partner organizations

Hire and train a capable network of practitioners who can survey for and monitor cone production across public and private lands.

Action Steps

1. **Identify community-connected partners with the interest, capacity and ability to hire crews for summer 2025**
   - **Description**: Conduct outreach to community-connected partners who work within the fire perimeters to develop a list of organizations who would have the interest, capacity and ability to hire seasonal staff in 2025 given additional funding
   - **Expected outcomes**: Initial grant scoping with National Forest Foundation
   - **Responsible parties**: American Forests, National Forest Foundation
   - **Result**: Larimer Conservation District identified as key partner with interest, capacity and ability to hire for the 2025 field season

2. **Scope grants, invite submissions and award grants**
   - **Description**: Develop the request for proposal, identifying geographic scope, number of staff and outlining time requirements and alternative activities (i.e., regeneration surveys)
   - **Expected outcomes**: Award grant to Larimer Conservation District to hire seasonal staff for 2025
   - **Responsible parties**: National Forest Foundation
   - **Result**: Larimer Conservation District expected to hire four seasonal staff to conduct cone surveys and monitoring as well as regeneration surveys

3. **Hire staff to conduct seed surveys and monitoring across Northern Colorado**
   - **Description**: Larimer Conservation District will hire seasonal staff to conduct cone surveys and monitoring during the summer and fall of 2025
   - **Expected outcomes**: Hiring efforts will result in a functional seasonal staff devoted to identifying and monitoring cone crop production across Northern Colorado, providing an overview of potential collection locations and timing
   - **Responsible parties**: National Forest Foundation, Larimer Conservation District, Arapaho and Roosevelt National Forests
   - **Timeline**: May 2025

4. **Identify interested community-connected partners with interest and capacity to support seasonal staff for summer of 2026 and beyond**
   - **Description**: Conduct outreach to community-connected partners who work within the fire perimeters to develop a list of organizations who would have the interest and capacity to hire seasonal staff given additional funding
   - **Expected outcomes**: At least three identified partners with capacity and interest to hire seasonal staff
   - **Responsible parties**: American Forests, National Forest Foundation, Colorado Forest Restoration Institute
   - **Timeline**: January 2025

5. **Scope Grants, Invite Submissions, and Award Grants**
   - **Description**: Develop the request for proposals, focusing on multi-year grants to ensure there is consistent expectation of funds over multiple years, identifying geographic scope, number of staff, and outlining time requirements and alternative activities (i.e., regeneration surveys)
   - **Expected outcomes**: At least four grants awarded to organizations interested in supporting seed collection
   - **Responsible parties**: National Forest Foundation, American Forests
   - **Timeline**: May 2026

6. **Hire staff to conduct seed surveys and monitoring across Northern Colorado**
   - **Description**: Community-connected partners will hire seasonal staff to conduct cone surveys and monitoring during the summer and fall of 2026
   - **Expected outcomes**: Hiring efforts will result in a fully functional seasonal staff devoted to identifying and monitoring cone crop production across Northern Colorado, providing an overview of potential collection locations and timing
   - **Responsible parties**: National Forest Foundation, American Forests, Arapaho and Roosevelt National Forests, community-connected partners identified in 1.3.1.1
   - **Timeline**: May 2026

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SPECIFIC ACTION 1.3.2

Host cone survey and monitoring training for Norther Colorado reforestation staff across organizations

Ensure that cone crews are consistently and appropriately trained to conduct cone surveys and monitoring and foster a sense of collaboration and collective action.

Action Steps

1. Identify and convene a Cone Survey and Monitoring Training Committee
- **Description**: Identify and convene a Cone Survey and Monitoring Training Committee responsible for developing and hosting the Cone Survey Training and a Cone Monitoring Training
- **Expected outcome**: Committee formation
- **Responsible parties**: New Mexico Highlands University, National Forest Foundation, American Forests, Colorado Forest Restoration Institute, The Nature Conservancy, Colorado State University Extension Jefferson County
- **Timeline**: January 2025

2. Develop funding strategy, timeline, curriculum and agenda for the Cone Survey Training
- **Description**: The Cone Survey Training Committee will develop a plan outlining funding sources, curriculum, attendees, agenda and date(s) of the 2025 Cone Survey Training
- **Expected outcome**: A planning document to support the Cone Survey Training
- **Timeline**: January 2025 through June 2026

3. Host the Cone Survey Training
- **Description**: A comprehensive training co-hosted by local organizations that will prepare crews for seed surveys
- **Expected outcome**: Coordinated event that will train survey and monitoring crews and empower them to complete their cone survey work with the required knowledge, resources and tools to excel in their positions
- **Responsible parties**: The Cone Survey and Monitoring Training Committee
- **Timeline**: Early/mid July 2025

4. Develop funding strategy, timeline, curriculum and agenda for the Cone Monitoring Training
- **Description**: The Cone Monitoring Training Committee will develop a plan outlining funding sources, curriculum, attendees, agenda and date(s) of the 2025 Cone Survey Training
- **Expected outcome**: A planning document to support the Cone Monitoring Training
- **Timeline**: January 2025 through July 2025

5. Host the Cone Monitoring Training
- **Description**: A comprehensive training co-hosted by local organizations that will prepare crews for cone monitoring
- **Expected outcome**: Coordinated event including multiple organizations that will train survey and monitoring crews and local community-connected partners, empowering them to monitor cone crops
- **Responsible parties**: The Cone Survey and Monitoring Training Committee
- **Timeline**: August 2025

SPECIFIC ACTION 1.3.4

Secure regional seed source options

Explore opportunities to invest in seed expertise and stability within the region.

Action Steps

1. Identify opportunities to develop seed orchards or seed production zones across Northern Colorado
- **Description**: Local partners will explore opportunities to expand seed production in Northern Colorado
- **Expected outcome**: List of potential locations and next steps
- **Responsible parties**: American Forests, Colorado State Forest Service, Colorado Forest Restoration Institute
- **Timeline**: Mid-2025

2. Improve local access to local seed extraction, processing and storage for community-connected partners and the Arapaho and Roosevelt National Forests
- **Description**: Local partners will explore opportunities to increase seed-related capacity across Northern Colorado to facilitate improved access to collected seed
- **Expected outcome**: Identify opportunities to increase nursery, seed storage and seed extraction via Colorado State Forest Service nursery expansion
- **Responsible parties**: Colorado State Forest Service
- **Timeline**: Mid-2026

1.4

Overarching Task

Develop workforce to conduct regeneration surveys on NFS lands

Developing a workforce versed in regeneration surveys will increase the number of ground-truthed acres on the ground, certify natural regeneration, and confirm geospatially identified planting opportunities across the fire footprints.

SPECIFIC ACTION 1.4.1

Develop a seasonal workforce managed by various community -partner organizations

See Action Steps for Task 1.3.1. These steps will be repeated for regeneration surveys, combining seasonal staff time to support both cone surveys and monitoring as well as regeneration surveys.

SPECIFIC ACTION 1.4.2

Host regeneration survey training for Northern Colorado reforestation staff across organizations

See Action Steps for Task 1.3.2. These steps will be repeated to train staff on regeneration survey methodologies as well as cone surveys and monitoring.

2

Support forest resilience

Increase knowledge, planning and implementation of reforestation activities that support forest resilience to wildfire, pests and pathogens, and extreme conditions.

2.1

Overarching Task

Develop an adaptation plan for Northern Colorado

Use existing knowledge of forest vulnerability, reforestation practices and adaptation to outline a strategic path forward for implementing resilient reforestation across all fire-impacted landscapes in Northern Colorado.

SPECIFIC ACTION 2.1.1

Outline a plan to develop an all-lands adaptation strategy

Action Steps

1. **Coordinate with relevant federal, state and community-connected partners to chart a path forward to create an all-lands adaptation strategy for Northern Colorado**
   - **Description**: Facilitate continued conversations with partners and the ARP to identify opportunities and needs to develop the plan
   - **Expected outcome**: Needs, next steps and process outline identified for plan development
   - **Responsible parties**: USFS, American Forests, National Forest Foundation, Colorado Forest Restoration Institute
   - **Timeline**: Early 2026
2. **Address needs identified in Action Step 2.1.1.1**
   - **Description**: Identify and pursue next steps to secure the necessary funding, partnership group and buy-in from partners and the Arapaho and Roosevelt National Forests and Medicine Bow-Routt National Forest
   - **Expected outcome**: Strategic plan for moving Adaptation Plan forward
3. **Develop the Adaptation Plan**
   - **Description**: Create and disseminate the Adaptation Plan
   - **Expected outcome**: Management-oriented plan that can be considered when developing implementation plans
4. **Coordinate with forest researchers to highlight key information gaps and needs to improve implementation outcomes**
   - **Description**: Ensures that Adaptation Plan is developed in coordination with local researchers to identify and advance key gaps and questions associated with resilient reforestation
   - **Expected outcome**: List of key gaps and identified researchers who will address those gaps

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3

Identify and develop innovative funding solutions to support reforestation on public and private lands

3.1

Overarching Task

Identify funding opportunities

SPECIFIC ACTION 3.1.1

Work through the reforestation collaborative (Overarching Task 1.1) to develop a funding strategy to support collaborative funding initiatives

Action Steps

1. **Develop a reforestation funding subcommittee of the Reforestation Pipeline Collaborative to identify funding opportunities and areas for collaboration, including opportunities for federal, state, foundation, science and other funds**
   - **Description**: Identify organizations interested in supporting funding initiatives
   - **Expected outcome**: Subcommittee group developed to support funding strategy development
   - **Responsible parties**: The Reforestation Collaborative (see Overarching Task 1.1)
   - **Timeline**: Late 2025
2. **Develop a funding strategy**
   - **Description**: Subcommittee will work together to create a funding strategy that addresses collaborative needs across the landscape
   - **Responsible parties**: The Reforestation Collaborative (see Overarching Task 1.1)
   - **Expected outcome**: Funding strategy shared with all community connected partners
   - **Timeline**: Late 2026

SPECIFIC ACTION 3.1.2

Promote, support and integrate the Colorado State Forest Service's Restoring Colorado Forest Fund (RCFF) into broader private lands reforestation initiatives

The RCFF is a donor-funded program that provides no-cost seedlings to forest landowners who have experienced forest loss as a result of wildfire or other disturbance. The fund also provides technical support to landowners including consideration of climate factors. Planting is supported by landowners.

Action Steps

1. **Develop a communications plan to educate community-connected partners and landowners about the RCFF**
   - **Description**: To increase awareness about the RCFF for eligible landowners, potential donors and community-connected partners, the Reforestation Collaborative will develop a communications plan
   - **Expected outcome**: Funding strategy shared with all community-connected partners
   - **Responsible parties**: The Reforestation Collaborative (see Overarching Task 1.1)
   - **Timeline**: Mid-2027

4

Support monitoring and research across Northern Colorado

Ongoing research and monitoring are crucial to long-term reforestation success, including forest resiliency.

4.1

Overarching Task

Support and expand ongoing monitoring and research across the wildfire footprints

SPECIFIC ACTION 4.1.1

Promote and support continued funding for ongoing monitoring and research initiatives

See Specific Action 3.1.1: Funding strategy development should include strategies to continue ongoing research and monitoring initiatives.

4.2

Overarching Task

Increase acres monitored across the fire footprints

SPECIFIC ACTION 4.2.1

Develop a cohesive monitoring protocol that can be used to track reforestation outcomes across all lands

The monitoring protocol should address key reporting requirements for the USDA Forest Service yet function to support inference across all land ownership types. Data collection should be feasible by USDA Forest Service personnel.

Action Steps

1. **Convene a group comprised of researchers, managers and other experts to develop the protocol**

   American Forests is working to support additional implementation monitoring across the western U.S. through its Keystone Agreement, including protocol development and piloting. Incorporation of Northern Colorado experts working on public and private lands reforestation will ensure the protocol can be deployed across jurisdictions and provide valuable information for land managers to improve reforestation outcomes.

   - **Description**: Identify group of experts best suited to developing the protocol
   - **Expected outcome**: Convening of a working group who can support protocol development
   - **Responsible parties**: American Forests, Northern Institute of Applied Climate Science (NIACS), Colorado Forest Restoration Institute
   - **Timeline**: Late 2025

2. **Develop an implementation monitoring protocol**
   - **Description**: The implementation monitoring protocol is expected to leverage monitoring protocol development work being done by groups like NIACS to decrease time to pilot data collection and leverage the thought work already developed in

this space. Currently, the anticipated structure is to have a "backbone" protocol that addresses USFS minimum reporting requirements, with additional modules that will be developed to address other questions, e.g., assisted migration, water provisioning, carbon sequestration

- **Expected outcome**: Pilot implementation monitoring protocol
- **Responsible parties**: American Forests, NIACS
- **Timeline**: Summer 2026

SPECIFIC ACTION 4.2.2

Pilot the implementation monitoring protocol

1. Hire seasonal staff to collect monitoring data

- **Description**: Crews will follow the pilot protocol on one fire footprint, collect and analyze data, and identify areas where the pilot protocol needs improvement/ modification
- **Expected outcome**: Pilot implementation monitoring protocol
- **Responsible parties**: American Forests, NIACS
- **Timeline**: Summer 2026

4.3

Overarching Task

Promote and support continued integration of operational plantings and research

Promote and support research initiatives that address questions associated with reforestation implementation, including but not limited to operational practices, stock type, forest adaptation and nursery procedures.

SPECIFIC ACTION 4.3.1

Identify key reforestation research needs specific to Northern Colorado

1. Host a summit to identify key research gaps necessary to support successful reforestation activities that support the recovery of resilient forests

- **Description**: Responsible parties will organize and host a summit of reforestation researchers and land managers to identify research needs specific to Northern Colorado
- **Expected outcomes**: List of key questions, and a manuscript highlighting those findings
- **Responsible parties**: Colorado Forest Restoration Institute, American Forests
- **Timeline**: December 2026

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5

Increase reforestation on private lands

5.1

Overarching Task

Increase outreach and education for private lands

Although community-connected partners have successfully reforested private land across some of the fire footprint, private land reforestation has been geographically spotty and contingent upon landowner perceptions and personal interest.

SPECIFIC ACTION 5.1.1

Continue to develop and disseminate education and outreach material to support reforestation awareness and knowledge

Continuing education and outreach will be key to ensuring that reforestation actions are completed and use best available research to support sound implementation. Education and outreach material, like *Ponderosa Pine Seed Collection on the Colorado Front Range: A Field Guide* (Schloegel et. al 2024) should continue to be developed to support increased technical knowledge and better implementation.

Action Steps

1. **Identify a suite of necessary educational material and assign responsibility to organizations to develop each item in the list**
   - **Description**: A comprehensive list of educational material needed to support basic technical reforestation knowledge in Northern Colorado
   - **Expected outcome**: A list of desired educational materials and who is responsible for each product
   - **Responsible parties**: The Reforestation Collaborative (see Overarching Task 1.1)
   - **Timeline**: Late 2026

SPECIFIC ACTION 5.1.2

Develop an outreach and education strategy for private landowners to facilitate additional reforestation activities in locations where it is still needed

Action Steps

1. **Create a plan to develop, fund and implement an education and outreach strategy for private landowners**
   - **Description**: A detailed plan that will guide funding acquisition and development of a landowner outreach strategy
   - **Expected outcome**: An actionable strategy to fund, develop and implement a landowner outreach strategy
   - **Responsible parties**: The Reforestation Collaborative (see Overarching Task 1.1)
   - **Timeline**: Late 2026

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5.2

Overarching Task

Plan and implement cross-jurisdictional reforestation projects, where applicable, to support continued reforestation of private lands

SPECIFIC ACTION 5.2.1

During implementation planning, check with managers and/or community-connected partners to determine need, interest and outreach opportunities for adjacent private lands

Action Steps

1. Strengthen relationships between reforestation practitioners among federal and state agencies, community-connected partners, and others involved in reforestation to promote information sharing, cross-jurisdictional planning and improved efficiency
   - **Description**: Fostering and strengthening the relationships among individuals and organizations involved in reforestation is a prerequisite to success given that relationships are key to successful reforestation across all lands
   - **Expected outcome**: Networking opportunities specific to reforestation, e.g., the Reforestation Collaborative
   - **Responsible Parties**: The Reforestation Collaborative (see Overarching Task 1.1)

2. Create an information-sharing network to support cross-jurisdictional outreach and collaboration
   - **Description**: The plan will develop deliverables that promote cross-jurisdictional communication, community building, planning and implementation
   - **Expected outcome**: Contact lists and maps of areas covered to promote community building
   - **Responsible parties**: The reforestation collaborative (see Overarching Task 1.1)

Appendix

Ⓐ Reforestation assessment

Geospatial assessment of reforestation opportunity

1. Ecological need
2. SFS categories

Table A1

Number of acres within each USFS reforestation category base on Arapaho and Roosevelt National Forests by fire, life zone (e.g., major forest type) and forest district.

Fire	District name	Activity code	Activity name	Life zone	Acres
2002 Big Elk	Canyon Lakes	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	1,356
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	472
		4431	Plant trees	Lodgepole-Upper Montane	753
		4431	Plant trees	Ponderosa-Lower Montane	56
		4453	Natural recovery	Lodgepole-Upper Montane	974
		4453	Natural recovery	Ponderosa-Lower Montane	405
2000 Bobcat	Canyon Lakes	4382	Certification of natural regeneration without site prep	Grassland-Lower Montane	8
		4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	133
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	796
		4431	Plant trees	Grassland-Lower Montane	5
		4431	Plant trees	Lodgepole-Upper Montane	35
		4431	Plant trees	Ponderosa-Lower Montaine	161
		4453	Natural recovery	Grassland-Lower Montane	1
		4453	Natural recovery	Lodgepole-Upper Montane	128
		4453	Natural recovery	Ponderosa-Lower Montane	902
2020 Calwood	Boulder	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	122
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	713
		4431	Plant trees	Lodgepole-Upper Montane	263
		4431	Plant trees	Ponderosa-Lower Montane	1,498
		4453	Natural recovery	Lodgepole-Upper Montane	40
		4453	Natural recovery	Ponderosa-Lower Montane	592
2020 Cameron Peak	Canyon Lakes	4382	Certification of natural regeneration without site prep	Grassland-Lower Montane	4
		4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	28,067
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	6,592
		4382	Certification of natural regeneration without site prep	Spruce-Fir-Upper Montane	4,301

A Reforestation assessment Appendix

Table A1 (continued)

Fire	District name	Activity code	Activity name	Life zone	Acres
2020 Cameron Peak	Canyon Lakes	4431	Plant trees	Grassland-Lower Montane	20
		4431	Plant trees	Lodgepole-Upper Montane	35,822
		4431	Plant trees	Ponderosa-Lower Montane	6,405
		4431	Plant trees	Spruce-Fir-Upper Montane	8,155
		4453	Natural recovery	Grassland-Lower Montane	132
		4453	Natural recovery	Lodgepole-Upper Montane	52,672
		4453	Natural recovery	Ponderosa-Lower Montane	8,307
		4453	Natural recovery	Spruce-Fir-Upper Montane	22,519
		4453	Natural recovery	Subalpine	77
2020 East Trou-blesome	Sulphur	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	19,214
		4382	Certification of natural regeneration without site prep	Spruce-Fir-Upper Montane	2,768
		4431	Plant trees	Lodgepole-Upper Montane	23,727
		4431	Plant trees	Spruce-Fir-Upper Montane	9,871
		4453	Natural recovery	Lodgepole-Upper Montane	20,443
		4453	Natural recovery	Spruce-Fir-Upper Montane	10,785
		4453	Natural recovery	Subalpine	149
2010 Fourmile Canyon	Boulder	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	54
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	63
		4431	Plant trees	Lodgepole-Upper Montane	16
		4431	Plant trees	Ponderosa-Lower Montane	17
		4453	Natural recovery	Lodgepole-Upper Montane	12
		4453	Natural recovery	Ponderosa-Lower Montane	152
2012 High Park	Canyon Lakes	4382	Certification of natural regeneration without site prep	Grassland-Lower Montane	120
		4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	4,975
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	5,209
		4382	Certification of natural regeneration without site prep	Spruce-Fir-Upper Montane	99
		4431	Plant trees	Grassland-Lower Montane	5
		4431	Plant trees	Lodgepole-Upper Montane	6,123
		4431	Plant trees	Ponderosa-Lower Montane	3,678
		4431	Plant trees	Spruce-Fir-Upper Montane	131
		4453	Natural recovery	Grassland-Lower Montane	1,487
		4453	Natural recovery	Lodgepole-Upper Montane	2,904
		4453	Natural recovery	Ponderosa-Lower Montane	0
		4453	Natural recovery	Spruce-Fir-Upper Montane	13
2003 Overland	Boulder	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	88
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	252
		4431	Plant trees	Lodgepole-Upper Montane	310
		4431	Plant trees	Ponderosa-Lower Montane	342
		4453	Natural recovery	Lodgepole-Upper Montane	46
		4453	Natural recovery	Ponderosa-Lower Montane	196
2004 Picnic Rock	Canyon Lakes	4382	Certification of natural regeneration without site prep	Grassland-Lower Montane	142
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	247
		4431	Plant trees	Grassland-Lower Montane	5
		4431	Plant trees	Ponderosa-Lower Montane	31
		4453	Natural recovery	Grassland-Lower Montane	956
		4453	Natural recovery	Ponderosa-Lower Montane	1,416
2017 Red Feather	Canyon Lakes	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	19
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	21
		4453	Natural recovery	Lodgepole-Upper Montane	675
		4453	Natural recovery	Ponderosa-Lower Montane	418
2018 Red Feather Rx	Canyon Lakes	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	719
		4382	Certification of natural regeneration without site prep	Ponderosa-Lower Montane	3
		4453	Natural recovery	Lodgepole-Upper Montane	1,129
		4453	Natural recovery	Ponderosa-Lower Montane	279
2018 Sugarloaf	Sulphur	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	6
		4382	Certification of natural regeneration without site rep	Spruce-Fir-Upper Montane	219
		4431	Plant trees	Spruce-Fir-Upper Montane	326
		4453	Natural recovery	Lodgepole-Upper Montane	12
		4453	Natural recovery	Spruce-Fir-Upper Montane	595
		4453	Natural recovery	Subalpine	55
2002 Unnamed	Canyon Lakes	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	1
		4453	Natural recovery	Lodgepole-Upper Montane	128
2020 Williams Fork	Sulphur	4382	Certification of natural regeneration without site prep	Lodgepole-Upper Montane	2,435
		4382	Certification of natural regeneration without site prep	Spruce-Fir-Upper Montane	3,271
		4382	Certification of natural regeneration without site prep	Subalpine	2
		4431	Plant trees	Lodgepole-Upper Montane	1,976
		4431	Plant trees	Spruce-Fir-Upper Montane	1,868
		4453	Natural recovery	Lodgepole-Upper Montane	1,271
		4453	Natural recovery	Spruce-Fir-Upper Montane	3,575
		4453	Natural recovery	Subalpine	159

B Prioritization

Additional variables considered for prioritization

1 Data layers from the ARP

a. Scenic Integrity (USFS 2009 Forest Plan)
- Not available for all lands
- Not a requirement from USDA Region 2 or the Washington Office of the USDA Forest Service

b. Suitable Timber Base (USFS 2009 Forest Plan)
- Included as a policy constraint rather than prioritization

c. Lynx Habitat (Southern Rockies Lynx Amendment)
- Based on pre-fire habitat
- Planting won't restore habitat for a long time
- It would be more important to protect remaining habitat

2 Climate layers

a. Increase in number of days above 95th percentile historic Keetch-Byran Drought Index (KBDI) (Martinuzzi et al. 2019)
- Similar to change in CMD

b. Change in minimum January temperature (AdaptWest)
- Highly correlated with change in maximum January temperature
- Initial evidence from ongoing CFRI research suggests that change in maximum January temperature is a better indicator of seedling survival than change in minimum January temperature

c. Change in precipitation as snow (AdaptWest)
- Highly correlated with change in CMD
- Initial evidence from ongoing CFRI research suggests that change in maximum January temperature is a better indicator of seedling survival than change in precipitation as snow

d. Forward climate velocity (AdaptWest)

e. Percent change in water yield (F2F)
- HUC 12 resolution

3 Probability of success

a. Probability of regeneration after severe fire 2001–2020 (Davis et al. 2023)
- Moderate resolution
- We chose to include individual variables in this model

4 Ecosystem services

a. Ability to produce clean water (Forests2Faucets (F2F))
- The group preferred prioritizing structures and storage vulnerable to sedimentation

b. Watershed importance to downstream users (F2F)
- The group preferred prioritizing structures and storage vulnerable to sedimentation
- Downstream users were defined only in the nearest sense — did not consider Colorado River very important, overemphasized Front Range

c. Carbon stock (CSFS)
- Pre-fire condition
- Uncertainty in restoring landscape to historical condition
- May be related to site growing conditions like TWI and HLI which were prioritized

d. Trails (USGS NTD)
- Linear feature doesn't align well with planting units
- Very small amount of area within 100 meters of trails compared to total planting need

e. Recreation sites (USFS)
- Very small amount of area within 500 meters of recreation sites compared to total planting need
- May be prioritized under other funding sources

5 Values-at-risk

a. Surface water intakes (F2F)
- The group preferred water structures derived from Colorado Division of Water Resources

b. Roads (USDA Forest Service, Open Street Map)
- Linear feature doesn't align well with planting units
- Included in accessibility constraints

c. Wildland Urban Interface (Radeloff et al. 2018)
- Very small amount of area compared to total planting area

6 Vegetation

a. Departure from historic fire regime (LANDFIRE)

b. Basal Area (species specific; Wilson et al. 2013)
- Pre-fire condition
- Uncertainty in restoring landscape to historical condition
- May be related to site growing conditions like TWI and HLI which were prioritized

c. Mortality from mountain pine beetle in Lodgepole (Hicke et al. 2020)
- Some evidence of reduced serotiny, but unsettled — Chuck Rhodes

d. Mortality from all bark beetles, all species (Hicke et al. 2020)
- Analysis already includes all areas unlikely to regenerate naturally

7 Wildlife
- None of the wildlife layers were considered in the final prioritization. There was greater emphasis on restoring ecosystem function, which is hoped to then benefit wildlife. There were also no wildlife experts in the group, so there was uncertainty on the appropriateness of the data and whether simply prioritizing a species range, for instance, was beneficial compared to better informed wildlife management actions.

b. Lynx potential habitat (Colorado Parks and Wildlife)

c. Preble's critical habitat (U.S. Fish and Wildlife Service)

d. Preble's range (Colorado Parks and Wildlife)

e. Potential conservation areas (Colorado Natural Heritage Program)

f. Tier 1 fish biodiversity (Colorado Parks and Wildlife)

g. Tier 1 wetland wildlife biodiversity (Colorado Parks and Wildlife)

h. Elk severe winter range (Colorado Parks and Wildlife)

i. Elk migration corridors (Colorado Parks and Wildlife)

8 Archaeology
- Lack of reliable data
- Require surveys for compliance so will need to be addressed regardless

HUC12 watershed	Landowner	No policy or accessibility constraints				Has policy and/or accessibility constraints			
Acres planting opportunity by priority		High	Mid-High	Low-Mid	Low	High	Mid-High	Low-Mid	Low
Big Thompson	City of Fort Collins	50	233	267	163	0	0	2	0
	Colorado State Land Board	16	170	168	11	5	41	20	0
	National Park Service	0	0	0	0	951	183	23	0
	Private	177	1,654	1,993	930	6	64	128	65
	USFS - Arap-aho and Roosevelt National Forests	4,086	7,432	7,375	5,361	346	1,031	1,153	1,028
Cache La Poudre	City of Fort Collins	298	22	0	17	10	0	0	6
	City of Gree-ley	0	1	6	7	0	0	0	0
	Colorado Parks & Wildlife	21	14	2	0	22	9	0	0
	Colorado State Land Board	130	108	108	111	3	0	9	6
	Colorado State Uni-versity	4	21	2	0	0	0	0	0
	National Park Service	0	0	0	0	1,990	1,557	179	1
	Private	3,051	675	802	1,335	207	65	136	189
	US Bureau of Land Manage-ment	0	0	0	0	0	0	0	0
	Arapaho and Roosevelt National Forests	11,484	9,757	8,022	4,773	9,666	8,557	5,190	2,268
Upper Colorado Head-waters	Colorado State Land Board	0	2	27	2	0	0	0	0
	National Park Service	59	91	66	15	3,994	2,691	863	124
	Private	176	185	302	128	2	0	0	18
	U.S. Bureau of Land Manage-ment	148	1,019	1,256	1,229	32	596	543	175
	Arapaho and Roosevelt National Forests	8,473	9,827	13,236	12,090	184	377	1,162	1,201
	Medicine Bow-Routt National Forest	15	475	1,743	2,035	29	637	2,325	10,493
St. Vrain	Boulder County	0	34	20	724	0	3	2	12
	Private	0	11	148	879	0	2	20	44
	U.S. Bureau of Land Manage-ment	0	7	71	193	0	5	8	8
	Arapaho and Roosevelt National Forests	0	34	287	1,758	0	3	54	321
Upper Laramie	Arapaho and Roosevelt National Forests	1,055	111	0	0	1,027	12	0	0

C Northern Colorado post-fire reforestation capacity survey

The survey is available online here.

Capacity survey

The following capacity survey is being conducted to assess current, future and desired capacity for post-fire reforestation across wildfires that burned in Northern Colorado between 2000 and 2020. The information collected from this survey will help to support strategic planning for increasing the pace and scale of post-fire reforestation within the region.

Instructions

Please take no more than 15 minutes to fill out the following information. Estimates are sufficient; please do not engage in data deep dives unless you would like to.

Respondent profile

Name (First Last)

We will use this information to ensure duplicate answers from the same person are not recorded.

Organization

We will use this information to ensure duplicate answers from the same organization are not recorded.

Job title

Email address

Please enter your email address if you are open to us contacting you about any follow up questions.

Reforestation role

What role does your organization/department currently play in post-fire reforestation?

- ○ Nursery operations
- ○ Seed extraction, processing and/or storage
- ○ Project coordination (planning, NEPA, etc.)
- ○ Implementation (includes cone collection, planting, etc.)
- ○ Monitoring/research
- ○ Funding
- ○ Other
  Please explain other role

What roles are you interested in playing in the future?

- ○ Nursery operations
- ○ Seed extraction, processing and/or storage
- ○ Project coordination (planning, NEPA, etc.)
- ○ Implementation (includes cone collection, planting, etc.)
- ○ Monitoring/research
- ○ Funding
- ○ Other
  Please explain other future role

Nursery operations

What is your current maximum CONTAINER seedling capacity?

What is your average annual CONTAINER seedling production?

What is your current maximum BARE ROOT seedling capacity?

What is your average annual BARE ROOT seedling production?

What proportion of total seedling capacity is currently available to supply seedlings to the Arapaho and Roosevelt National Forests?

Do you feel you have sufficient nursery capacity to meet the current demand?
- ○ Yes
- ○ No

Do you feel you have sufficient nursery capacity to meet expanded future demand?
- ○ Yes
- ○ No

Are you planning any nursery expansions?
- ○ Yes
- ○ No

What is the expected year of completion for your nursery expansion?

What will your TOTAL CONTAINER seedling capacity be after expansion?

What will your TOTAL BARE ROOT seedling capacity be after expansion?

What will your TOTAL seed extraction capacity be in pounds after expansion?

What will your TOTAL seed processing capacity be in pounds after expansion?

What will your TOTAL seed storage capacity be in pounds after expansion?

What proportion of total capacity will be available to supply seedlings to the Arapaho and Roosevelt National Forests after expansion?

What is the biggest bottleneck to increasing your annual nursery production (e.g., funding, demand, consistent demand, seed, etc.)?

What would alleviate those bottlenecks?

If those bottlenecks were alleviated, would you devote more capacity to increasing seedling production?
- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Seed processing, extraction and/or storage

If you didn't select "seed processing" as one of your current roles, you can proceed to the next section

Do you have seed extraction, processing or storage capacity?
- ○ Yes
- ○ No

What is your current seed extraction capacity in pounds?

What proportion of that extraction capacity is currently available to the Arapaho and Roosevelt National Forests?

What proportion of that extraction capacity is currently available to non-National Forest System lands in Northern Colorado?

What is your current seed processing capacity in pounds?

What proportion of that processing capacity is currently available to the Arapaho and Roosevelt National Forests?

What proportion of that processing capacity is currently available to support reforestation on non-National Forest System lands in Northern Colorado?

What is your current seed storage capacity in pounds?

What proportion of that storage capacity is currently available to the Arapaho and Roosevelt National Forests?

What proportion of that storage capacity is currently available to support reforestation on non-National Forest System lands in Northern Colorado?

What is the biggest bottleneck to increasing your extraction, processing and/or storage capacity?

If those bottlenecks were alleviated, would you devote more capacity to extraction, processing and/or storage?
- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Current seed collection capacity

Has your organization previously surveyed for collectable conifer cone crops?
- ○ Yes
- ○ No

Has your organization previously monitored collectable conifer cone crops?
- ○ Yes
- ○ No

Has your organization previously collected conifer seed?
- ○ Yes
- ○ No

Approximately what is the maximum number of bushels your organization has collected in one year since 2021?

Approximately what is the minimum number of bushels your organization has collected in one year since 2021?

What role did you play in the collection? (e.g., surveys, monitoring, collection, contracting, coordination, etc.)

What is the biggest bottleneck to increasing your annual seed collection efforts?

What would alleviate those bottlenecks?

If those bottlenecks were alleviated, would you devote more capacity to cone collection?
- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Current planting capacity

Approximately how many acres per year, on average, has your organization planted since 2021?

What is the approximate MAXIMUM number of acres per year your organization has planted since 2021?

What role did you play in the planting (e.g., contracting, inspection, seedling procurement, etc.)?

What is the biggest bottleneck to increasing your annual acres of seedling planting (e.g., funding, demand, property access, seed, workforce capacity, contractors, etc.)?

What would alleviate those bottlenecks?

If those bottlenecks were alleviated, would you devote more capacity to planting seedlings?

- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Current monitoring/research capacity

Over approximately how many acres per year, on average, has your organization conducted any post-fire reforestation or regeneration monitoring/research since 2021?

Over approximately how many acres per year, at maximum, has your organization conducted post-fire reforestation or regeneration monitoring/research?

Provide a brief summary as to what you are intending to accomplish with your monitoring/research work.

What is the biggest bottleneck to increasing the number of acres over which your organization conducts monitoring/research?

What would alleviate those bottlenecks?

If those bottlenecks were alleviated, would you devote more capacity to monitoring/research?

- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Workforce capacity

How many full-time equivalents (FTEs) currently work on post-fire reforestation at your organization?

Consider a FTE to be a unit of measurement comparing hours worked by part-time employees to the average number of hours worked by a full-time employee or student. For example, if your organization had one full-time employee dedicated to reforestation and another that only devoted 20 hours/week to reforestation, the number of FTEs would be 1.5.

Of those, how many FTEs are seasonals?

How many FTEs does your organization currently devote to seed collection related activities?

How many FTEs does your organization currently devote to outreach/education and/or community project building on private lands?

Do you anticipate growing the number of FTEs working on post-fire reforestation in the next five (5) years?

- ○ Yes
- ○ No

How many additional FTEs do you anticipate adding to your INTERNAL reforestation capacity?

How many additional FTEs do you anticipate adding to your EXTERNAL reforestation capacity?

Where do you envision this additional capacity for reforestation will be directed?

What is the biggest bottleneck to increasing your workforce capacity for reforestation?

If those bottlenecks were alleviated, would you hire more people for reforestation?

- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Funding

Does your organization host funding opportunities that support post-fire reforestation (e.g., CSFS's Restoring Colorado's Forest Fund or NRCS' EQUIP)?

- ○ Yes
- ○ No

Where can information about that program be found?

Where have you gotten funding to support post-fire reforestation to date?

Do you know of any funding opportunities that could be developed?

Do you have the capacity to apply for additional funding for post-fire reforestation to boost internal capacity?

- ○ Yes
- ○ No

Do you have the capacity to apply for additional funding for post-fire reforestation to boost external capacity?

- ○ Yes
- ○ No

What is the biggest bottleneck to increasing the number of funding opportunities to which your organization applies?

What would alleviate those bottlenecks?

If those bottlenecks were alleviated, would you devote more capacity to applying for funding?

- ○ Yes
- ○ No
- ○ Maybe

What else would you add that we missed?

Thank You!

Thank you for completing the survey! Your response has been recorded. We appreciate your time and the invaluable information that you've provided to help us scale up post-fire reforestation in Northern Colorado.

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